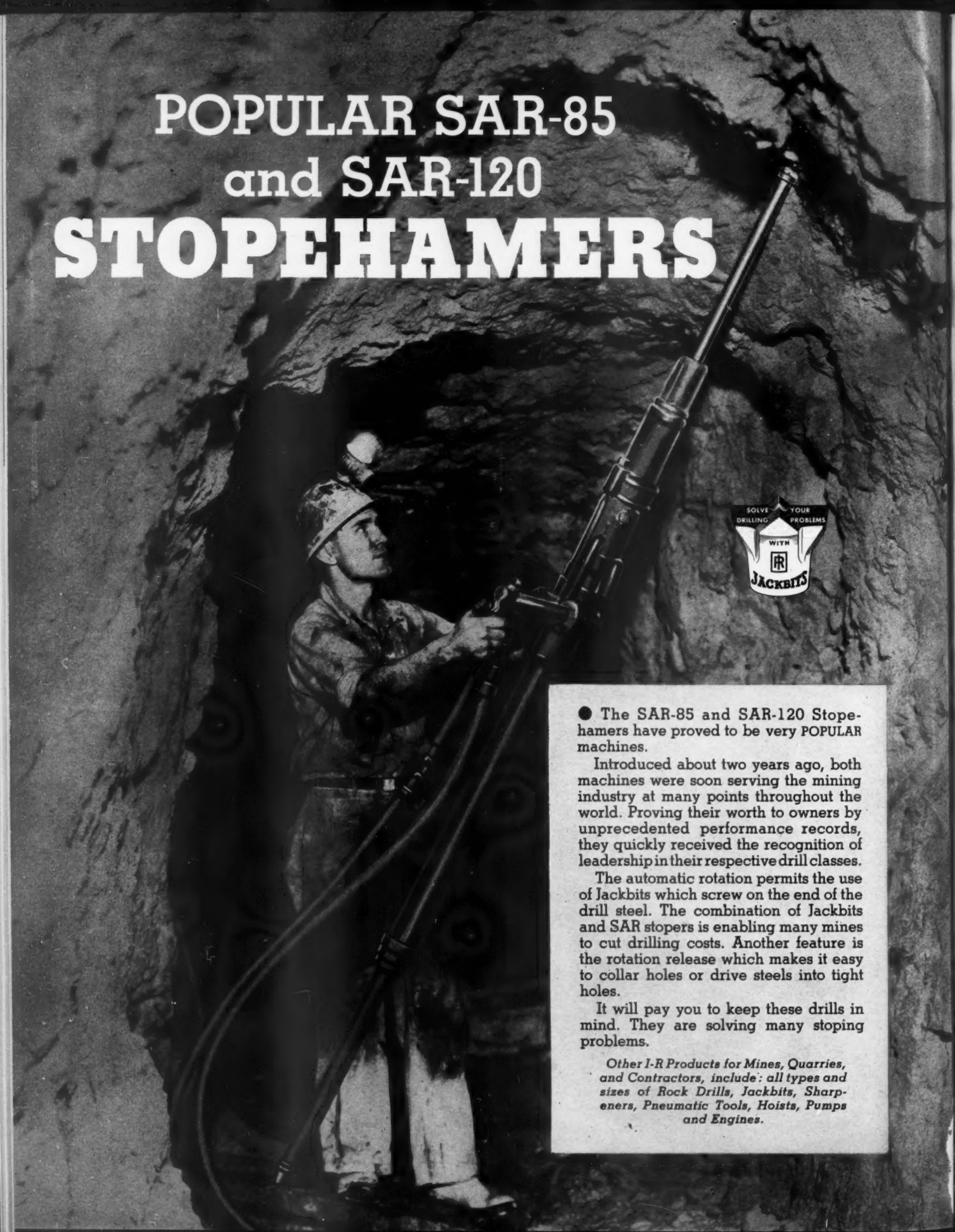
Compressed Air Magazine

Vol. 43, No. 7 London - New York - Paris July, 1938

STEEL INGOT FOR ROLLING RAILS

POPULAR SAR-85 and SAR-120 STOPEHAMERS



● The SAR-85 and SAR-120 Stopehamers have proved to be very POPULAR machines.

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ON THE COVER

THE cover picture shows an ingot of steel being lifted from a soaking pit after having been heated to rolling temperature. The photograph was taken in the rail mill of the Carnegie-Illinois Steel Corporation at Gary, Ind. It is reproduced through the courtesy of that concern.

•

IN THIS ISSUE

TREASURE hunts are always romantic affairs, and those at the bottom of the sea are especially intriguing. The latest effort to recover the bullion and specie that sank with the British frigate *La Lutine* 139 years ago should add another spectacular chapter to the absorbing story of previous expeditions.

•

THE description of the construction of France's longest railroad tunnel should be of particular interest to American engineers for the reason that the scheme followed differs in many respects from prevailing practices in this country. The author of the account was one of the engineers in charge of construction.

•

WHEN a conservative concern such as W. & J. Sloane makes sweeping claims for a new process, it must possess unusual merit. Accordingly, since it carries the Sloane endorsement, we feel that the new veneering procedure described in this issue means better furniture for everybody.

•

THE Magic Door is one of the mechanical marvels of the age that commands among adults an interest akin to that shown by a child in a new toy. Although of great practicability, the Magic Door didn't catch on fast at first, and the company that originated it had a hard time selling the initial installation. Today, however, every city of any size in the country has at least one to serve and amuse its populace. A few years hence they may, perhaps, be considered essential equipment for many kinds of retail establishments and factories.

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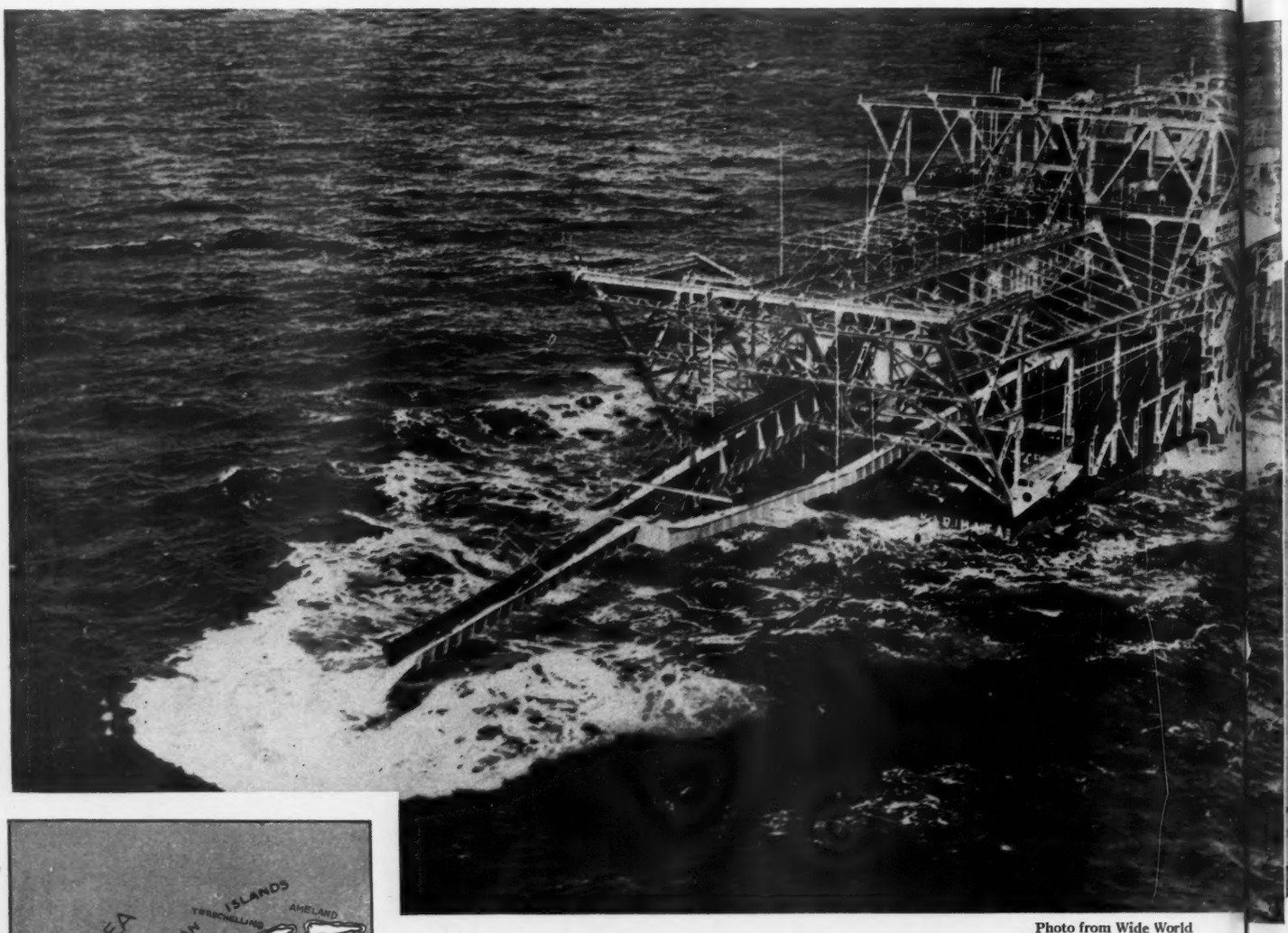
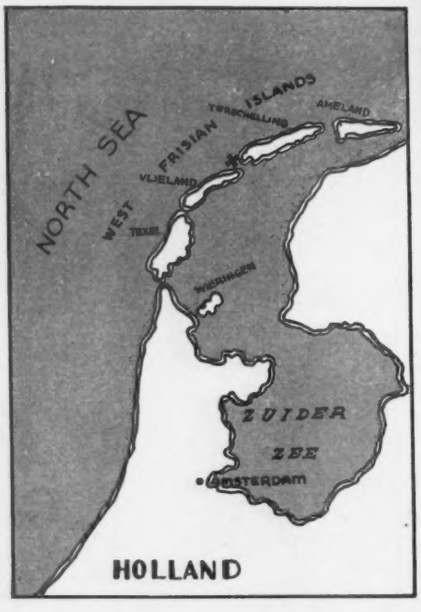


Photo from Wide World



LLOYD'S BID FOR PRIZE

The "Karimata," a shallow-drafted dredge boat with which the celebrated London firm of underwriters is seeking to recover the $5,000,000 in treasure that is believed to be still buried in the shifting sands at the entrance to the Zuider Zee. Lloyd's paid the full loss at the time of the disaster; but the records showing the value of the cargo were destroyed by fire in 1838. "La Lutine" lies in 60 feet of water at the point off the coast of Holland marked by the cross, an exposed position swept by strong tidal currents.

TREASURE hunters, making use of a seagoing dredge built especially for the purpose, are once more seeking to recover from the wreck of the British frigate *La Lutine* the bars of gold and silver, as well as specie, that are believed to be still buried in the submerged shifting sands and the treacherous waters adjacent to the Island of Terschelling, one of the seaward bulwarks of the Zuider Zee.

At intervals, ever since that richly laden craft went to her doom 139 years ago, salvage efforts, both modest and pretentious, have sought to reclaim the bullion and specie that were lost when the ship was stricken. It is a matter of record that the net result of those varied endeavors has been the recovery of the equivalent of more than $504,000. The tantalizing part of that accomplishment is that no small part of the treasure was removed from the wreck with the very simplest of salvage facilities. During the 91 years following her loss, only 28 working days were fruitful; and it was the summer of 1858 that yielded the richest returns, the salvors then reclaiming bars of bullion having a reputed value of $184,680. How much more the vessel actually had aboard at the time of the disaster will probably never be known; but there is warrant for the belief that there still remains embedded in the submerged sand at the site of her foundering treasure having an aggregate value of $5,000,000.

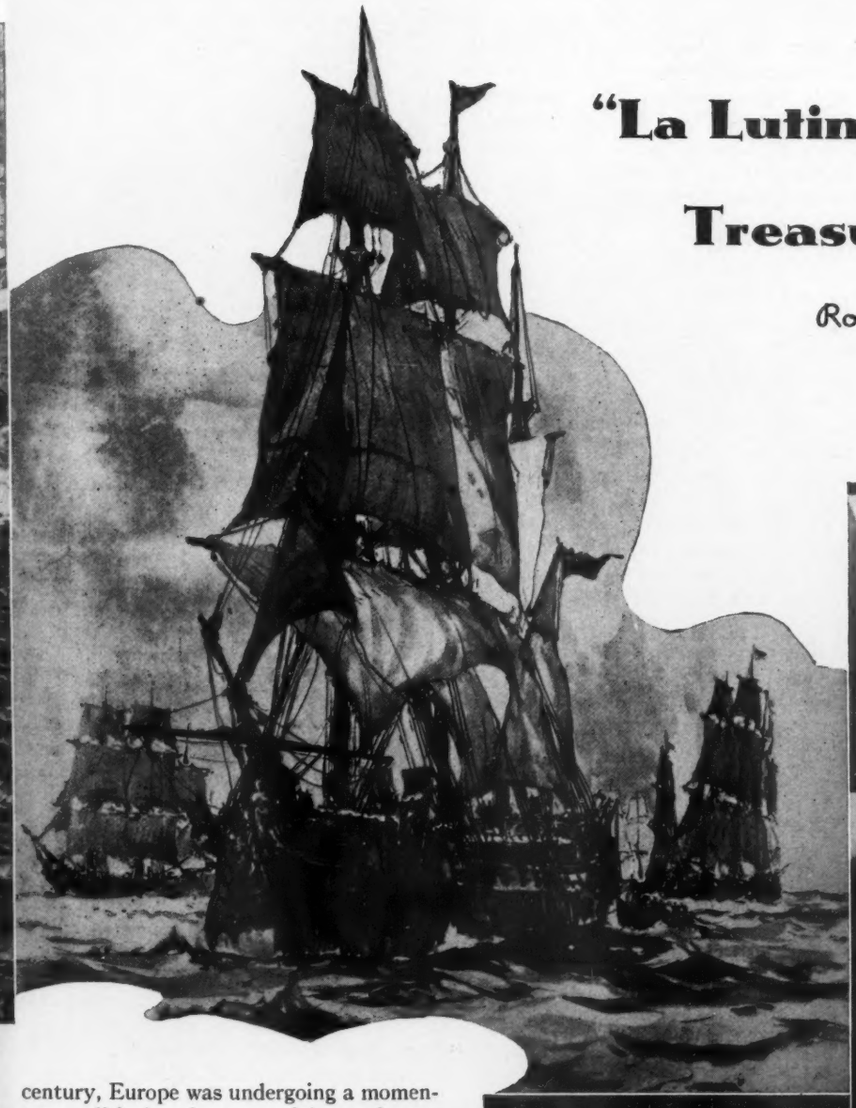
Lloyd's of London, the historic association of British underwriters, is directly interested in the salvage efforts now in hand, and for that work has had built the large marine dredge *Karimata* at Kinderdyk, Holland, and placed the operation of that craft in the hands of a Netherland company. The Dutch, with their seagoing shell dredges, have been employed at different times in the past in attempts to clear the hulk of sand and to pump up from the site values in one form or another. In the present undertaking, Lloyd's is profiting by that experience.

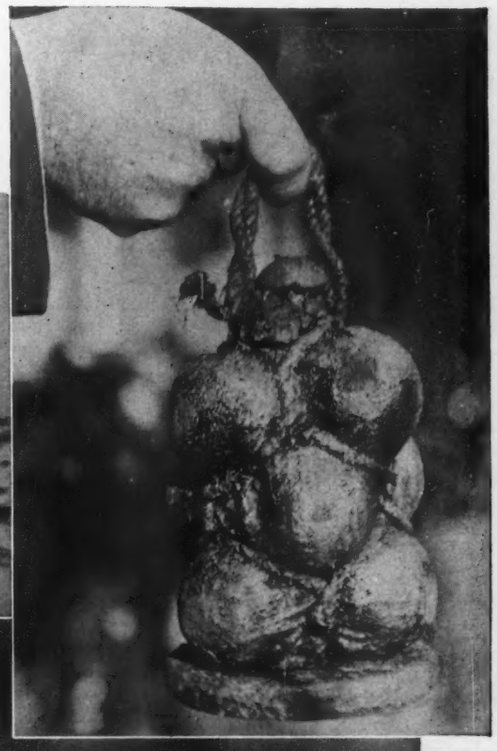
Why a warship was used in 1799 to transport treasure from England to the continent is one more reminder that financial crises are not peculiar to any age and generation nor to any single nation. There is a bit of irony in the fate of *La Lutine*, because that ship was captured by the British from the French but eight years prior to her destruction; and when she sank off the North Sea Coast of Holland, that country was under the dominance of France.

In the closing years of the eighteenth

"La Lutine" Again Lures Treasure Hunters

Robert G. Skerrett





century, Europe was undergoing a momentous political and commercial transformation. During that era of flux, the Port of Hamburg suddenly acquired a business importance of unlooked for magnitude, and that historic center of trade abruptly became the principal market for nearly the whole or northern Europe. That unexpected mercantile growth placed a tremendous tax upon the banking resources of Hamburg, and delays in payments, arising out of the war between England and France, led to many failures among German business houses. It was then the custom to ship goods from England into Germany and to draw bills payable many months later so as to allow ample leeway for the merchandise to be sold and for money to be realized with which to meet the bills when due. Exchange between London and Hamburg at that critical period entailed the enormous charge of 30 per cent upon bills returned to London.

Alive to the fact that further distress threatened if the money market became more pinched, a considerable number of wealthy banking houses in England determined to relieve the situation by advancing funds to their Hamburg representatives wherewith to meet the bills of British mer-

THE ILL-FATED VESSEL AND SOME TREASURE

The British frigate "La Lutine" which struck a sand bar off the coast of Holland on the night of October 9, 1799, and sank. She sailed from Yarmouth, England, for Hamburg with bullion and specie aboard reputed to have been worth nearly $6,000,000. Also pictured are a handful of still shining coins and a charge of grapeshot recovered in 1911. This type of charge was fired by naval guns in the eighteenth century and later.

chants when due and thus avoid the heavy charge levied upon such commercial paper when discounted in London. The plan called for the shipping of unusually large sums; and the British Admiralty was asked either to send a Government convoy for the usual mail packet or to assign a naval craft to move the treasure. It was thus that *La Lutine*, a 32-gun ship of the royal fleet, was detailed to transport the consignment made famous by the loss of that vessel.

In those lively days, the stagecoach was the accepted overland means of travel and communication between London and the Port of Yarmouth where *La Lutine* was at anchor, and no stagecoach was large enough to carry more than a very small part of the bullion and specie intended for delivery to the frigate. Furthermore, there was the ever-present danger of attack by the picturesque and daring highwaymen of the period. To have employed slow and heavy carts would have necessitated a military guard, and that would have attracted undesirable publicity. Success hinged upon the utmost secrecy. As a result, not a single record remains to tell how the gold and silver were moved, how much bullion and specie from the Bank of England was placed aboard *La Lutine*, or where the treasure was actually stowed in the craft. So large were the shipments, however, that each banking house concerned sent a junior member to look after its interests and assigned to him a trusted secretary familiar with all the technicalities of commercial intercourse. From identifying marks on the bars subsequently recovered it has been proved that no fewer than fifteen banking firms were represented in the consignments of treasure. Furthermore, there is authority for the belief that the government dispatched specie to the value of $714,400 to be used for paying British troops then engaged in military operations against the French.

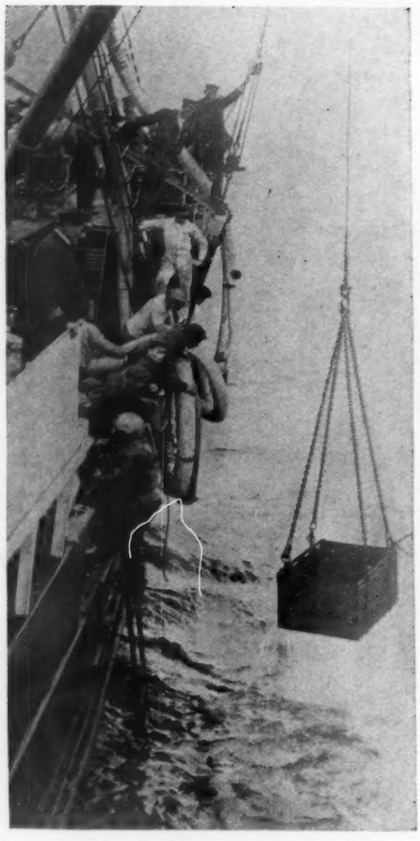
Laden with her precious freight, *La Lutine* sailed from Yarmouth Roads on October 9, 1799. The night of the same day, while running at a speed of 10 knots under the urge of a heavy northwesterly gale, she struck upon a sand bar about 2½ miles offshore and close to one of the entrances to the Zuider Zee between the islands of Vlieland and Terschelling. The ship hit the submerged barrier with such force that she was thrown instantly upon her beam's end; and of a total of nearly 300 persons aboard only two were picked up on the beach alive the morning following. Of those but one survived, and he was never able to give a coherent account of the disaster. The Dutch government insisted upon treating what remained of *La Lutine* and her cargo as spoils of war.

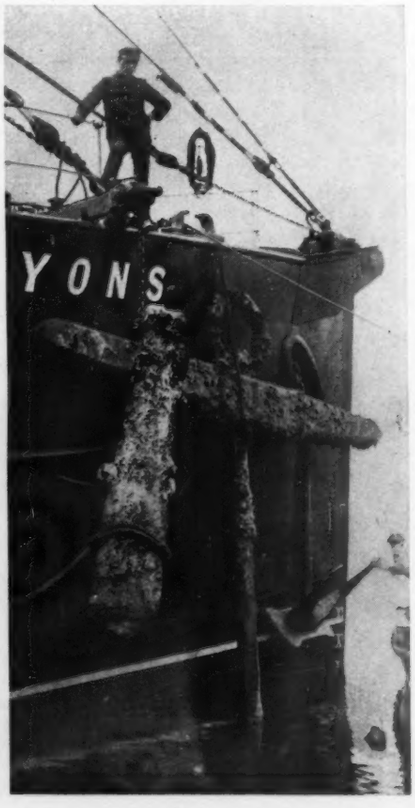
During the next two years operations were carried on under the Dutch government to salvage some of the sunken gold and silver. Native fishermen were employed for the work, and they utilized iron oyster tongs, iron nets, and nippers—the wreck being visible and in shallow water at low tide. With those crude instruments they recovered 58 bars of gold and 35 bars of silver, together with a few coins, having a total value of $278,850. Contemporaneous observers are on record as having seen numerous bars of the precious metals slip from the salvors' tongs and drop back into the sea; and it is said that the casks containing specie were broken open and their contents scattered on the sea bed from which they could not be reclaimed by the metal dip nets that were being used.

Before the close of 1801, the hulk was buried deep under the very formation that had caused her loss. Armed strife and accumulating sand effectually arrested further salvage operations until 1814, at which time the then official receiver of wrecks at Terschelling, Pierre Eschauzier, financed by a grant of 300 guilders from the King of Holland, endeavored to recover some of the buried riches. But beyond locating the sand-filled hulk and salvaging one gold piaster, eight silver piasters, and eight louis d'ors, nothing further was accomplished. From 1814 to 1856, none of the efforts to relocate the wreck or to find some of her treasure was successful; and work upon the hulk would not have been resumed when it was had not chance revealed the site of what remained of the shattered *La Lutine*.

In 1856, the pendent chain of a channel buoy that happened to be adrift caught in timbers of the frigate at a point where they projected above the sea bed, and The Decretal Salvors, a Dutch organization that had been granted a royal concession in 1821, at once made preparations to try to reclaim some of the long-lost treasure. The Decretal Salvors came into being through the enterprise of Pierre Eschauzier, who continued to keep watch over the watery area where *La Lutine* had disappeared, to note any improvements in the art of diving, and all the while to dream his dream of the riches that some day he might garner from the deep—incidentally sharing half of what might be recovered with the Dutch government. The latter, as a friendly gesture after years of conflict, assigned its interest in *La Lutine* to the "King of Great Britain." George IV accepted the right so conferred and promptly assigned it to Lloyd's as a possible source of partial indemnification for the total loss which they had immediately paid at the time of the disaster. This explains the interest of Lloyd's in the salvage operations now in progress.

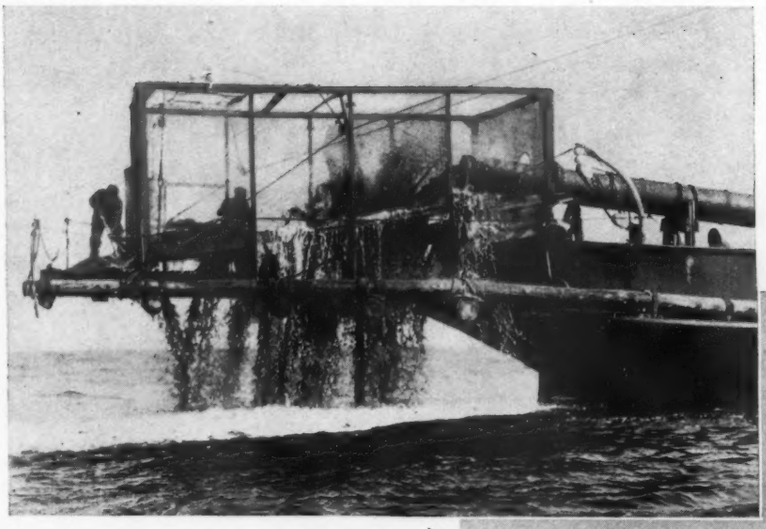
When The Decretal Salvors got busy in 1857, using diving dress for the first time on the wreck, only a few coins were brought to the surface during the limited number of days diving could be done by reason of favoring weather conditions. Work was

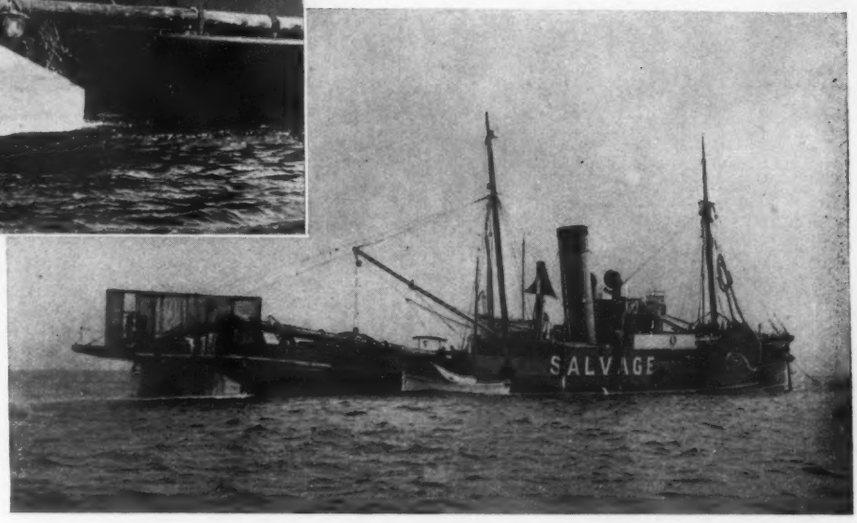




OPERATIONS BY THE "LYONS"

Pictures taken nearly 30 years ago during salvage efforts by the "Lyons." Above is shown a metal skip that was used to bring up articles of value. A diver is about to descend. In the lower view the anchor of "La Lutine" and one of her cannon are being hoisted aboard the salvage vessel.





SCREENING THE BOTTOM SAND

Additional views of the "Lyons" at work. This vessel was used during operations that began in 1910 and that were financed by a group of Scotchmen. This 537-ton craft was specially constructed for the salvage attempt; but three years of endeavor yielded comparatively little treasure. All the water pumped from the sea bed in an effort to remove the sand that enveloped the hulk was run through a screen at the stern of the "Lyons" to catch any solid material.

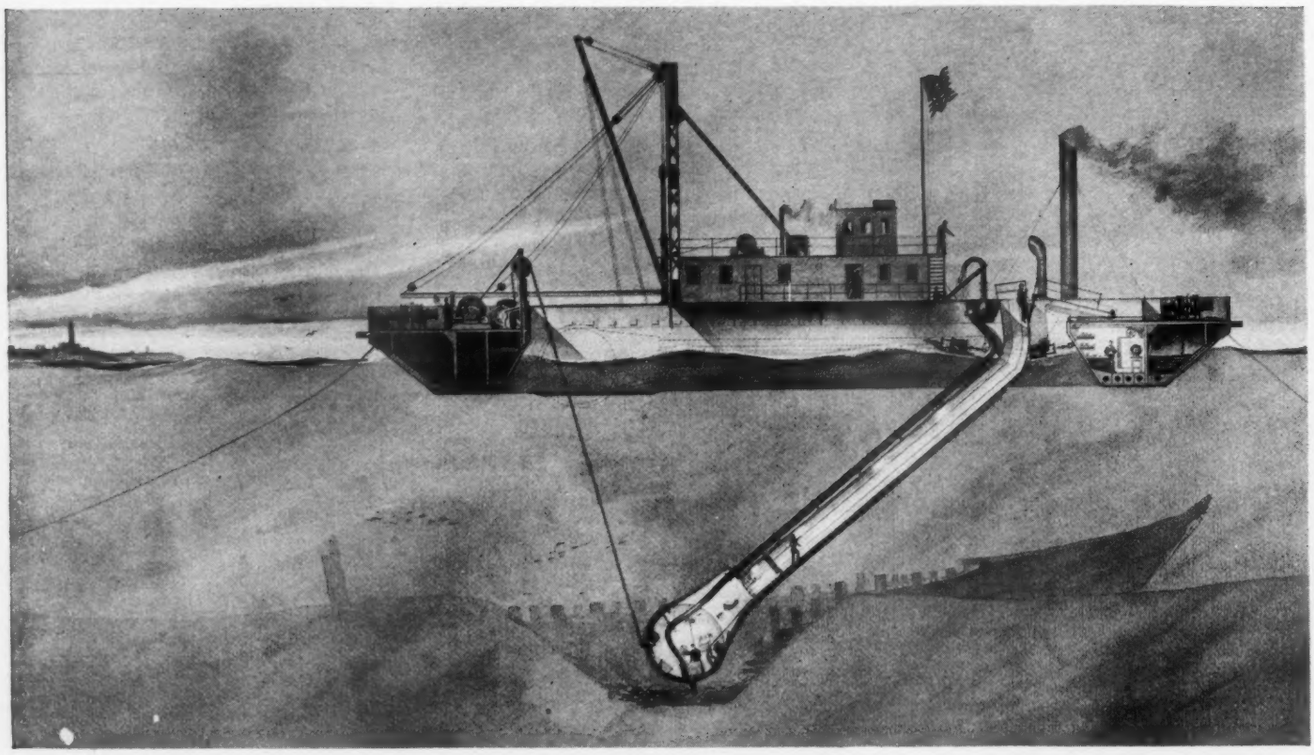
resumed in April of the following year; and at the beginning of June a single silver bar was recovered by the divers. When operations ended, about the middle of October, the salvors had to their credit for that season's activities bullion and specie totaling in value the equivalent of $184,680. Inspired by that achievement, they again set out in May of 1859; but a barrier of sand prevented the divers from reaching the area that had been so productive the previous year. When work was halted by the steadily burying sand, the returns for the season were five bars of gold and two of silver worth about $3,520—the last gold bar bearing the identifying mark of H. S. No. 13. Only trifling success rewarded the 1860 salvage attempts; but during the four consecutive years mentioned, they netted 42 bars of gold, 64 bars of silver, and some specie having a combined value of $214,442. The bullion was found close to the ship's rudder, which was still attached to the hulk in September of 1858, when it was unslung and lifted to the surface. Later it was used in fashioning a chair for the chairman of Lloyd's and a table that was placed in the secretary's anteroom. The removal of the rudder, which had shielded the treasure area, allowed the shifting sands to accumulate over that part of the sea bed and may have hastened the complete burial of the wreck.

In all the succeeding years, during which suction dredges of various capacities have been employed on occasions and even for several consecutive seasons, the materials and the gold and silver brought to the surface have not begun to pay for the outlays involved. The last most fruitful seasons have yielded, all told, 11,164 coins worth around $4,520. The foregoing fourth series of salvage operations, carried on from 1886 to 1888, inclusive, did not produce a single bar or bullion; and yet during the first years of their service the divers had reported the discovery of a layer of bars of bullion so firmly compacted and set in the sea bed that none could be detached! That was before the blanketing sand buried the hulk and made it impossible for divers to achieve anything. From time to time, the position of the wreck has been lost, and only a few years back it rested on a clay stratum at a depth of about 60 feet, with something like 40 or 50 feet of sand covering it. The area where the hulk lies is an exposed one that is swept by strong tidal currents and frequently by heavy seas. Indeed, during a working season, activities have repeatedly been limited to only a few scattered days in the course of months.

In 1910, 1911, and 1912, the English steamer *Lyons* of 537 tons displacement was engaged in salvage operations at the site of the wreck. That craft was financed by a group of wealthy Scotchmen, and was equipped with large suction pumps, a 3-ton lifting magnet, powerful reflecting electric lamps for night work, and a submarine pneumatic drill. The latter was used to put holes in a big pile of rust-cemented cannon balls for the insertion of charges of dynamite—the cannon balls being reasonably assumed to overlie some of the treasure. Circumstances made it impossible to drill and to blast the mound of metal. However, those salvors were probably on the right track, for on the night before the last year's work had to come to a close by reason of the weather, one of the pumps brought up, and discharged into the screen placed at the stern of the vessel for that purpose, a sizable piece of iron oxide bearing a sharply defined rectangular impress in the surfaces of which were glittering bits of gold! That impress agreed exactly with the dimensions of a bar of gold which was known to have been recovered from *La Lutine* and which is preserved in a museum in Amsterdam.

During her period of service, the *Lyons* reclaimed two anchors, numerous cannon balls, some old hand-wrought nails, two cannons—still loaded and indicating the ship's readiness to resist attack, a small quantity of silver and copper coins, and various pieces of waterlogged timber from the wreck itself. Such were the actual recoveries for an outlay of well over $100,000. The salvage steamer, drawing only 10½ feet of water, could not work safely at low tide in any kind of a seaway and had to be ready to leave her station and to run for harbor on the Zuider Zee flank of the Island of Terschelling in the course of only half an hour at the first sign of a stiff wind.

It is worth while recalling that Americans have given thought to salvage operations on this treasure ship, for in 1907 Simon Lake obtained the right to seek the long-buried gold and silver. He designed an un-



SIMON LAKE'S SALVAGE SCHEME

In 1907, Simon Lake, American submarine inventor, obtained the right to search for the sunken treasure. He proposed to make the sea bottom accessible to men by means of a cylindrical tube with a sphere at the bottom which was to contain a powerful pump for dredging the sand from the buried frigate. The tube was built, but the vessel was never constructed. The drawing was made by the author of this article in 1906, at which time he was associated with Mr. Lake.

usual shallow-drafted vessel capable of being moored over the area for exploration and of maintaining her station there at any stage of the tide and under a wide range of weather conditions. The Lake boat was to be equipped with a tube 95 feet long and 5 feet in diameter having at its lower end a cylindrical working chamber 8 feet in diameter. A powerful suction pump was to be placed in the latter where it would operate at greater efficiency than at the surface, and that pump was to do the dredging. A bottom doorway in the chamber was to permit divers to pass out on to the sea bed and to direct the activities of the dredge under especially favorable conditions. The tube was built at Brightlingsea, England, and performed well when tested. However, the associate vessel was not and has not been constructed.

The *Karimata*, now seeking what remains of the treasure originally transported by *La Lutine*, is a shallow-drafted craft having a rectangular hull and carrying powerful suction pumps with connecting tubes which can be lowered on to the sea bed. All the water thus lifted is discharged into screened sluices which can retain any solid bodies raised from the depths—the water then passing onward and overboard. The dredge is provided with hoisting apparatus and other facilities necessary to pursue the various phases of the work. The *Lyons* was a cross-channel steamer adapted to the needs of submarine salvage, while the *Karimata* has been built for the particular task on which she is now engaged. As yet, she has not recovered any of the treasure.

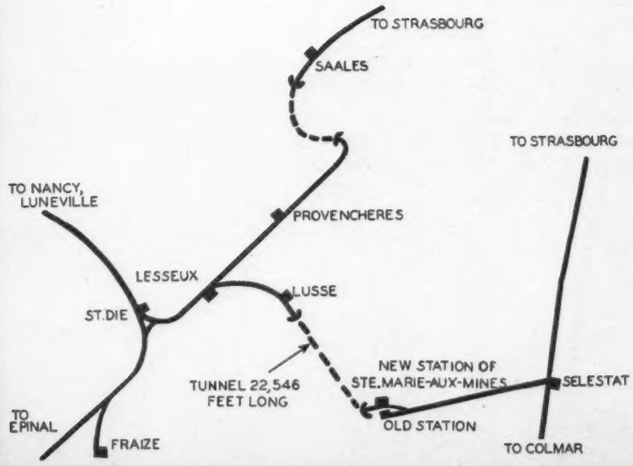
During the many years that have elapsed since *La Lutine* foundered, the wreck has been alternately visible and obscured by accumulating sand. Furthermore, her position has changed because she has been exposed to the surge of seas and the sweep of strong tidal currents. The hulk has been shattered in the course of time; and it is more than likely that much if not all her remaining precious cargo now lies scattered well outside of the surviving structural timbers.

Be this as it may, the lure persists even though the Royal Exchange in London was burned to the ground in January of 1838 and all Lloyd's records were then destroyed. Nevertheless a paper drawn up in 1821 by one of Lloyd's representatives at Amsterdam is authority for figures indicating that *La Lutine* carried insured bullion and specie to the total value of £1,207,000—the present-day equivalent of nearly $5,975,000. As late as 1895, the then assistant burgomaster at Terschelling deposed as follows: "In July, 1862, a diver examined the site of *La Lutine* and found, by pricking through the sand, a number of silver bars at a few inches in depth. He scraped away the sand with his hands, but was unable to get any of the silver bars sent up. Subsequent examinations were made by the same diver, and he found the silver bars forming a pavement about 12 feet square with 1 foot of sand or more over them, but they were lying so close together that he could not lift one or get an iron bar between them to separate them. They were lying outside of the vessel."

CANNON-FIRING MECHANISM

This device, raised from "La Lutine," once served one of her broadside guns.

The treasure hunt in the treacherous waters off Terschelling has resolved itself into an engineering problem; and whether the present enterprise and the *Karimata* prove successful, it is inevitable that ways and means will be devised in time by technicists and inventors to effect a clean-up of what may be left of *La Lutine's* original burden of precious metals. Some of it was not insured and would, therefore, swell the sum reported to have been on board the ship when she was lost.



THE TWO PORTALS

Views of the entrances at the two ends of the bore, showing the pleasing effect that was obtained by building up walls and arches of masonry. The map shows the tunnel location and indicates how it forms a connecting link between existing rail lines on either side of the Vosges Mountains. Its local importance is that it provides direct transportation between St. Die and Ste. Marie-aux-Mines.

France's Longest Railroad Tunnel

Paul Guillot

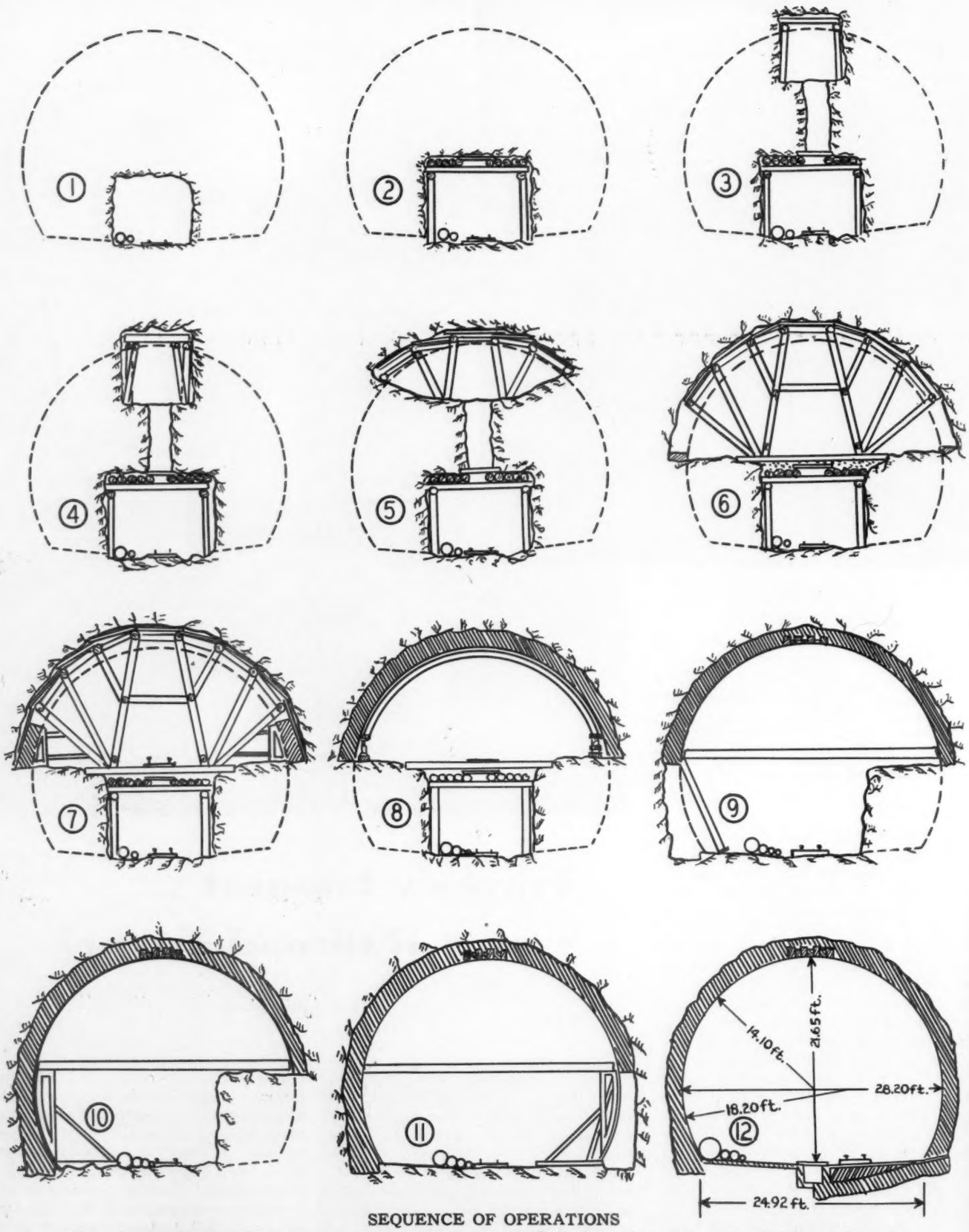
A RAILROAD tunnel, more than 4¼ miles long through the Vosges Mountains in eastern France was placed in service last fall after having been under construction for more than four years. It is part of a new section of line, 7½ miles long, that provides a direct connection between St. Die, on the western side of the mountains, and Ste. Marie-aux-Mines, on the eastern slope. It also offers an alternate route for Paris-Strasbourg trains and a third rail link between Alsace and Lorraine.

The tunnel is the first one driven through the Vosges range, although such a project had been under consideration for almost a century. The two earlier rail lines between Alsace and Lorraine both cross over the mountains, one at the northern end of the range and the other near its southern extremity. These are the Paris-Nancy-Strasbourg route, which was built through the Saverne Pass in 1861-62, and the Paris-Mulhouse route, which was constructed through the Belfort Gap in 1865-66. The distance between these two crossings is approximately 75 miles.

St. Die, a city of 22,000, and Ste. Marie-aux-Mines, with a population of 10,000, are but 15 miles apart by the new railroad. Previously, the only transportation facility between them consisted of one bus line traveling the highway through Ste. Marie Pass, which frequently is closed to traffic in the winter. Stimulation of commerce between these two centers and between other communities situated on opposite sides of the range was a primary consideration and had an important bearing on the decision to drive the tunnel. It is estimated that this local traffic will amount to 200,000 tons annually. A further reason for building the tunnel was that it would be of unquestionable military value in the event of war.

The new line was constructed under the authority of the French Government. It was initiated in a report made to the National Senate by General Bourgeois, member from the Department of Haut-Rhin, in which Ste. Marie-aux-Mines is located. The Senate and Chamber of Deputies approved the project on March 16, 1928, and on July 17, 1929, it was declared a matter of public utility.

Three possible routes, with maximum grades as high as 3.3 per cent and radii of curvature as little as 985 feet, were considered. The one adopted has the same



SEQUENCE OF OPERATIONS

These drawings illustrate the progressive steps in excavating the tunnel and lining it with concrete. The pilot bore, or bottom heading, was driven in advance of the other operations, and was holed through in a little more than nineteen months of working time. In unstable ground the scheme was modified slightly from that shown in No. 3, the width of the intermediate raise then being the same as that of the top heading. Broken rock from the upper workings was dropped through trap doors into cars running on tracks in the bottom gallery. As operations progressed, additional service pipe lines were laid until there were four, as indicated in the last five sketches. From left to right, they conveyed, respectively, ventilating air, compressed air for the drills, compressed air for the locomotives, and water.

CONTRACTOR'S PLANT

Buildings and equipment used in connection with the work prosecuted from the Ste. Marie-aux-Mines end. The largest structure seen in the picture at the left housed the compressors, which are shown below. There were six machines for supplying air to the rock drills, and two high-pressure units for charging the storage tanks of the compressed-air locomotives. All the units were belt driven from motors that aggregated 1,280 hp.

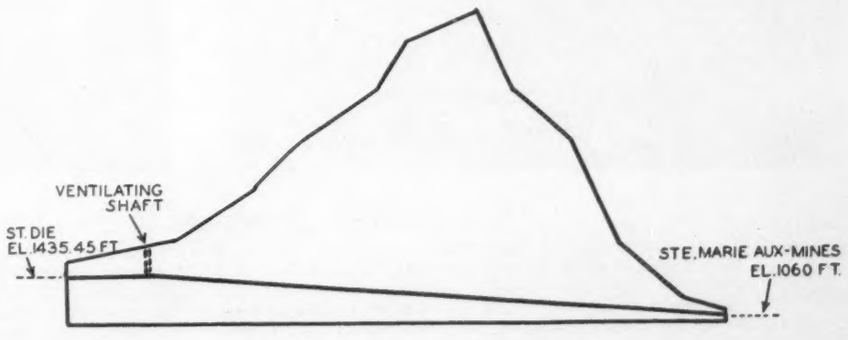
characteristics as the Ste. Marie-Selestat line with which it connects on the east—that is, a maximum grade of 1.8 per cent and a minimum radius of curvature of 1,640 feet. Track and platforms at all stations are practically level. On the western side the new road branches off the St. Die-Strasbourg line at Lesseux Station, approximately 7½ miles east of St. Die, following up the Le Bleu Valley to Lusse and entering the tunnel a short distance beyond it.

The exact length of the tunnel is 22,546 feet, making it the longest railroad bore located entirely in French territory. It has a cross section of 646 square feet, which is standard for all large French tunnels. As accompanying sketches show, it is of modified horseshoe shape. Although only one track has been laid thus far, the bore and its approaches were constructed so as to permit double-tracking later. For the present, trains are being drawn by steam locomotives; but the tunnel dimensions are large enough for subsequent electrification.

At the time of construction, there were excavated in the walls of the tunnel at intervals of 164 feet recesses in which workmen may take cover while trains are passing. These are staggered with respect to the sides of the bore. Every 1,640 feet a room was cut in one of the side walls to serve as a storage place for sand, gravel, and other materials for use in track maintenance work. A drainage ditch, with a settling basin every 164 feet, was dug in the floor along the center line of the tunnel. The walls and arch are lined with unreinforced concrete which varies in thickness from 12 inches to 27½ inches according to its position and also according to the character of the ground traversed. The keyway of the arch is made up of seven rows of concrete blocks of the same composition as the lining. These were manufactured on the job. Wherever the floor was in gneiss formation, that half of the section where track was placed was covered with a 4-inch layer of concrete. The other half will be concreted when the second track is laid.

From end to end, the tunnel passes through igneous rocks, but crustal movements and disturbances during past geological ages have broken them up to such an extent that they are relatively unstable and necessitated supporting the bore throughout most of its length during construction. Starting on the Lusse (west) side, the tunnel penetrates the gneiss formation of the Urbeis Mountains for approximately 10,000 feet. This gneiss proved to be considerably fissured, with graphitic clays filling the openings, and called for the general use of timbers. The line then passes through approximately 5,900 feet of porphyritic granite constituting the Central Vosges uplift, and next through 2,625 feet of amphybolitic-porphyritic granite. Both of these formations had numerous seams and openings and had to be supported for the most part. The final 4,000 feet is in the gneiss formation of the Ste. Marie Mountain. Here, again, fissures with fillings of graphitic clays were pronounced. On the whole, this gneiss was more unstable than that of the Urbeis Mountain range, at the other end of the bore, and required the generous use of supporting structures.

As laid out, the tunnel penetrates the western side of the range on the very slight upgrade of 0.1 per cent and maintains this for 3,067.5 feet to the high point, which is at an elevation of 1,500 feet above sea level. From there on, the grade is reversed, sloping downward first at 1.4 per cent and then at 1.3 per cent throughout the distance of 19,478.5 feet to the east portal. To permit any ground water that might be encountered to drain out by gravity so that it would not impede excavating, it was obviously desirable to work from the two ends toward the high point; and as by far the longest slope was on the eastern side,



PROFILE OF THE TUNNEL

SIX STEPS IN THE EXCAVATION SCHEME

No. 1 shows the bottom heading as at first driven, and No. 2 as it appeared after being widened and timbered. No. 3 shows the upper or arch section with fan-shaped timber sets in position for holding up the roof and with piles of muck along the center resting on the roof timbers of the lower gallery. No. 4 shows a similar section with a part of the concrete lining in place and with some of the forms for concreting the arch erected. No. 5 shows the upper wall and arch sections concreted, with the timbers removed from the bottom gallery and with the rock still in place at either side of it. No. 6 shows a section with one of these side "wings" removed and with the lower portion of the side-wall concrete poured in one area on the left. This procedure constitutes a modification of the Belgian method of tunneling.

CONSTRUCTING PILLARS

As shown in the progressive sketches of the work on another page, the upper walls and arch sections of the concrete lining were poured first, the rock meanwhile being left in place underneath the walls to support them. This rock was later removed in alternating sections and replaced with concrete to form virtually a series of pillars. The intervening rock was then excavated and concrete poured to make a continuous wall. One of the pictures shows excavations for two pillars separated by a zone of rock: the other shows forms in place for the second stage of concreting to complete a section of the wall.

operations were naturally begun at that end.

On May 15, 1933, actual work on the project was started. It consisted of excavating and grading at the site of the Ste. Marie Station, where an Ingersoll-Rand 25-hp. portable compressor supplied compressed air for the operation of tools. From there, the work proceeded toward the eastern portal of the tunnel and reached the weathered and decomposed gneiss rock on June 27.

A modification of the Belgian method of tunneling was used in driving the bore. The sequence of operations, which is shown in the accompanying sketches, was as follows: First- driving a rectangular heading approximately 60 square feet in cross section at the bottom center of the full tunnel section; second- timbering this opening; third- excavating a raise directly above this gallery and to a point about half way to the top of the finished tunnel line; fourth- extending this raise to the ultimate height and timbering it; fifth- stoping or widening this top gallery on both sides and timbering it; sixth- widening the first raise to full tunnel width on both sides and timbering it; seventh- pouring concrete "small walls" on top of the rock remaining at either side and extending them upward a few feet; eighth- lining the upper portion of the roof with concrete and placing the keyway of blocks at the top of the arch; ninth- excavating the *stross* or wings at either side of the original bottom heading; tenth- lining lower sections of walls with concrete; eleventh- excavating bottom drainage ditch and concreting it.

During the ninth step, the rock was removed only to the approximate finished line of the tunnel, leaving enough on each side to support the concrete lining that had previously been placed on top of it. In carrying out the tenth step, the remaining rock was excavated in sections, a few linear feet at a time, and spaced so as to leave intervening sections to support the overhead concrete. In substance, the bottoms of the walls were poured in the form of a series of pillars. After these had set sufficiently to carry the superimposed weight, the sections of rock remaining between adjoining pillars were removed and the spaces filled with concrete to form a continous wall.

The driving of the bottom heading or gallery was carried on independently of the other operations and in advance of them. This work was started at the Lusse or western end on October 30, 1933, or approximately four months after the beginning of operations at the eastern portal. As the volume of water encountered at the western end was very small, it was possible to drive on past the high point in the tunnel and down the opposite slope for a distance of approximately 1¼ miles. The two headings met there on June 5, 1935, or less than two years after work was started at the eastern portal. The deviation from the true line was but 7½ inches with respect to elevation and less than one inch in relation to side lines.

Each heading of this pilot tunnel was served by its own muck cars and electric locomotive. Each train consisted of two or three cars, and these were low enough to permit loading the broken rock into them by hand and had sufficient capacity to handle all the material from a blast in one trip. A track siding was maintained at a distance of not more than 800 feet back from the working face, and there a train of empty cars was stationed. After the cars at the heading had been loaded, the locomotive hauled them past the siding and left them there while it moved the empties up close to the working face. Returning to the loaded cars, it hauled them out to a point 1,500 to 2,000 feet distant, where they were attached to the train provided for the upper workings.

The pilot or base tunnel was timbered as work progressed, and the muck from the raise which was afterward excavated above it was deposited on its roof. From there, by opening trap doors, the material was gravity loaded into cars run beneath it. These upper workings were served at each end of the line by trains made up of fifteen cars of 4-cubic-yard capacity each and drawn by a Porter compressed-air locomotive. The cars that were hauled from the pilot-bore heading by the electric locomotive were attached to the rear of this train which pulled them out of the tunnel to the disposal dumps. The same locomotives and 15-car trains were used for carrying the material excavated from the bottom side sections—from the sections that were cut out in order to pour the lower portions of the concrete lining—and from the central drainage ditch. Spoil was loaded by hand, and sidings were placed at intervals frequent enough to permit loaded and empty trains of cars to pass each other and

COMPRESSED-AIR LOCOMOTIVE

Hauling in the bottom or pilot drift was done with Porter compressed-air locomotives the storage tanks of which were periodically charged with high-pressure air that was piped into the workings. Units of this type were formerly popular in mining work, and some are still in that service.

thus to avoid delays and loss of time.

Work was conducted 24 hours a day in three shifts of eight hours each. In the pilot bore, each crew consisted of a foreman, four miners, and six laborers. All drilling was done with Ingersoll-Rand S-49 Jackhamers. The number of holes in each drilling round varied from ten to fifteen in the zones of fissured gneiss and from fifteen to twenty in the hard gneiss and granite. The distribution of holes in a typical round in compact rock is shown in an accompanying diagram. The depth of holes ranged from 30 to 54 inches, according to the nature of the rock. Swedish hollow, hexagon drill steel of 1-inch section and with 4-point bits was used. These steels were reconditioned in an I-R No.4 drill-steel sharpener. All drilling was done dry; and after each blast a jet of water was played on the rock face to lay the dust and to show clearly the results of the explosion.

Each crew drilled and blasted an average of three rounds a shift. As soon after a blast as the working face was accessible, the drillers started putting in a new round of holes while the muckers were loading the broken material. The crew foreman, assisted by two miners, charged the holes, which were fired as soon as all the muck had been loaded and hauled away. The crew relieving each shift generally found the third blast just fired and the rock face ready for starting another round of drilling. Blasting was done with slow fuses, from 5 to 6½ feet long, and with No. 8 blasting caps. All holes in a round were fired at the same time, the lengths of the fuses being controlled so that they would detonate in the desired order. Each blasting round resulted in an advance of from 27 to 47 inches.

Jackhamers of the S-49 Type were also used in drilling the intermediate and top raises and in the widening work. In the raises, the crews drilled and blasted from two to three rounds each shift, more often three, and the advance made with each round was about the same as that in the lower pilot bore. The widening of the raises was ordinarily carried on in sections ranging in length from 325 to 820 feet. In these areas, blasting was done only when changing shifts, from 100 to 150 holes being fired at a time. In the case of the final excavating work—that of removing the lower portions of the side walls for placing the concrete pillars—blasting was done four times a shift, after each departure of a train laden with broken material. For drilling holes in the roof, in connection with the placing of timbers, Stopehamers were employed.

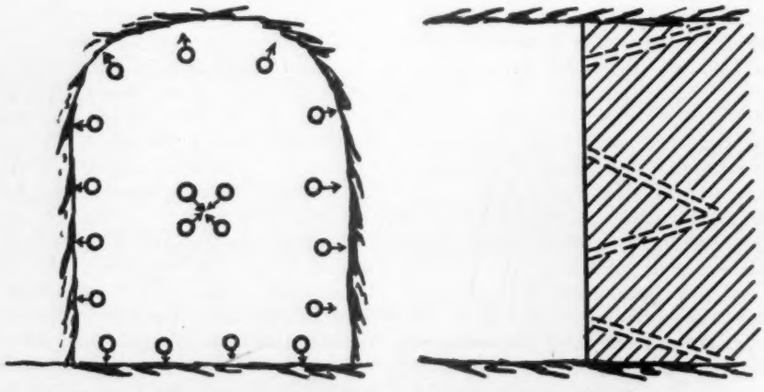
Two grades of dynamite were used, both of 30 per cent strength. One, known as Gum B, served for blasting the harder and more compact rock both in the pilot tunnel and elsewhere. The second, designated as No.2 was employed wherever the formation was somewhat broken or shattered. The consumption of Gum B per cubic yard of broken rock was 2.8 pounds in the pilot tunnel and 0.41 pound in the entire excavation. Respective figures for the No.2 dynamite were 0.47 pound and 0.81 pound. The average monthly advance from the Ste. Marie-aux-Mines end was 523.6 feet in the pilot tunnel and 531.5 feet in all other workings. From the Lusse end it was 522 feet in the pilot tunnel and 381 feet in the other workings.

During the driving of the pilot tunnel, ventilating air at the various working places was furnished by a fan at each end which forced the air through pipe lines made up of sections ranging in diameter from 39.4 inches down to 9.8 inches, according to the volume required at the different points. At first two Farcot fans were used, and these were later replaced by two Sulzer twin fans. After the pilot tunnel had been holed through, a natural draft was induced in the workings by the sinking of a shaft, 164 feet deep, which intersected the tunnel line at its high point 3,067 feet from the Lusse station.

The compressor plant was located at the Ste. Marie-aux-Mines end of the tunnel. It was equipped with six machines that supplied air for the rock drills and with two units that delivered high-pressure air for charging the tanks of the air-operated locomotives. All the compressors were of Ingersoll-Rand manufacture and were belt driven from motors that aggregated 1,280 hp. The compressor house also contained a repair shop for rock drills, with a workbench and compartments for spare parts. After a drill had been repaired, it was tested before being sent back into the workings to ascertain its air consumption.

Blacksmith shops for reconditioning drill steels were situated at each end of the tunnel. Dulled steels were transported to these shops on the muck trains and there sorted according to lengths and bit sizes by a blacksmith helper. Sharpened steels were taken into the tunnel by the empty trains.

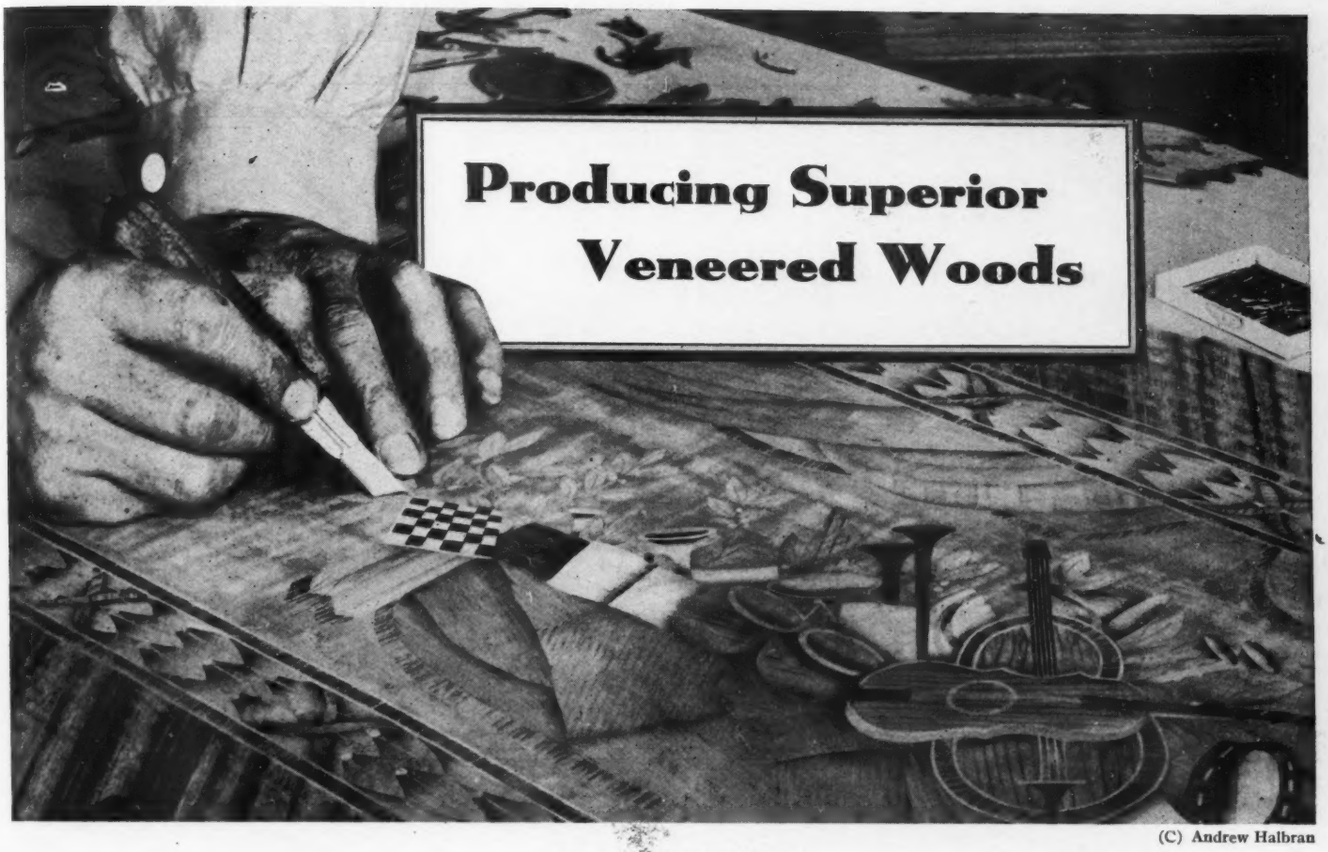
The work described was executed by Messrs. Borie and Vandewalle, a prominent firm of French contractors. The tunnel was formally opened to train traffic on August 8, 1937, by the President of the French Republic.



DRILL ROUND

Showing how the blasting holes were placed in hard ground in the bottom heading. Drilling was done with hand-held S-49 Jackhamers.

Producing Superior Veneered Woods



(C) Andrew Halbran

AID TO MARQUETRY

The new process of welding wood to wood promises to stimulate the ancient art of inlay work inasmuch as it can thereby be rendered more permanent than ever before. An expert is shown here completing an intricate design that involved the cutting, fitting, and assembling of more than 1,000 separate pieces of wood.

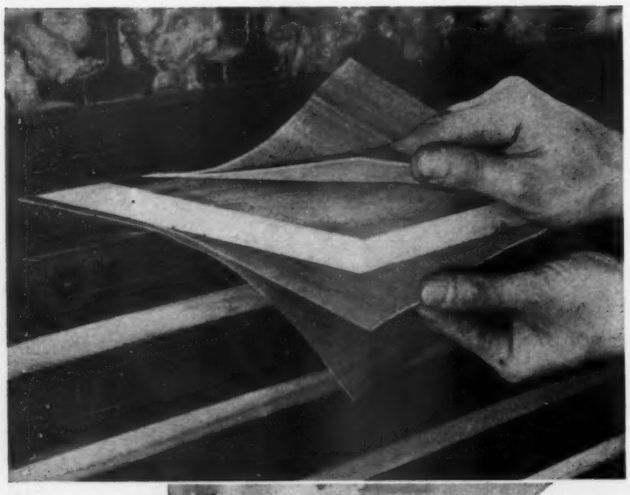
TWO recent developments have made it possible to produce veneered woods that are vastly superior to any previously turned out. Extensive tests indicate that panels of wood joined together by the new process are immune to peeling, lifting, and excessive checking—drawbacks which heretofore have affected the work of even the greatest craftsmen such as Chippendale, Sheraton, and Phyfe. The new veneers are also unaffected by seasonal changes and, apparently, will successfully withstand both the steam heat of modern houses and the severe climatic conditions that prevail in the tropics.

One of these developments consists of an improved hot press in which the pressure required to bind the various layers of wood together is applied through the medium of compressed air. The other is a glue having better adhesive properties than that formerly employed. Conjointly they make it practicable not only to turn out a better product but also to do the work in less time, and thereby reduce the cost. Both furniture and plywood manufacturers are showing great interest in the new equipment that has been made available, and the consuming public bids fair to be the gainer.

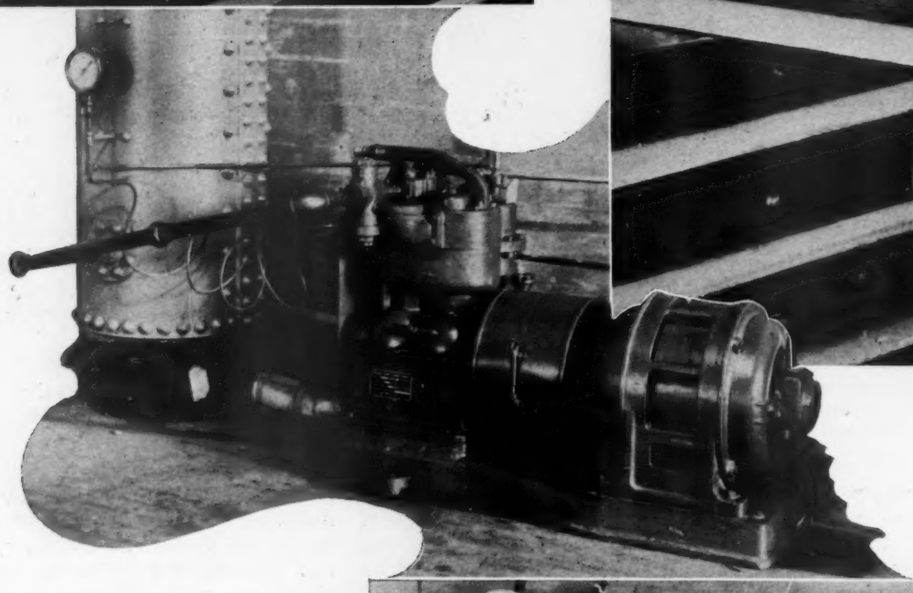
Veneered woods composed of several layers, compacted and with the grain in contiguous plies running at right angles to one another, have been preferred to solid wood for furniture making and for similar uses for centuries past because of their greater resistance to splitting and warping and because of the more varied decorative effects that can be obtained with them. For the sake of stability and lightness, inert softwoods are selected for the base. Ordinarily, two thin sheets of wood, called cross bands, are applied to both sides of this central core. The softwood represents by far the largest part of the finished piece; but all exposed surfaces are of the richer, more beautiful, and more enduring hardwood which is capable of taking a high polish and remains lustrous for a long time. The accepted method of consolidating the laminated assembly has been to bind the layers together with a cold glue carrying a high percentage of moisture, to press the bundle in a hydraulic press, and then to maintain the pressure for eight to ten hours by means of clamps.

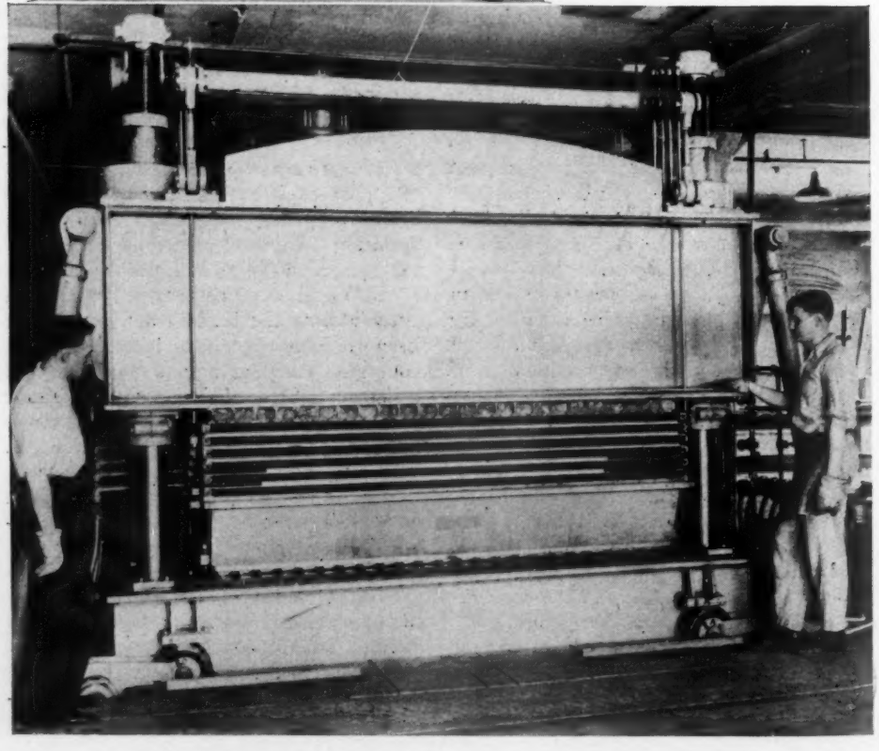
A successful hydraulic press known as the Hydroplat has been manufactured for a number of years by the Merritt Engineering & Sales Company, Inc., of Lockport, N. Y. That press has now been adapted to use compressed air and is being sold under the name of Aeroplat. Compressed air has definite advantages over water for the purpose of applying pressure. It is clean, flexible, and quick-acting. The only drawback is that when air is used at high pressure and in great volume it is more expensive than when water or oil is utilized and the desired pressure is obtained by pumping. The idea of operating the press under discussion with air was formerly considered impractical because of the great amount of it that would have been required. However, a change in design has made it possible to reduce the volume needed and thus to take advantage of its superior action and characteristics.

This was accomplished by making each of the two distinct functions of the press—1, opening and closing; 2, applying pressure—perform independent of the other. A press of this type consists of two horizontal platens between which the work is inserted, the space being sufficiently large to accommodate several tiers of wood, each separated from the succeeding one by a plate of aluminum or other metal. Closing the press involves bringing the upper and lower platens together to take up the "daylight," after which the squeezing is done by applying pressure on the underside of the lower platen. Obviously, closing calls for the movement of heavy weights through comparatively long distances. It is purely a mechanical operation that accomplishes no useful work and should, for the sake of economy, be performed as speedily as possible and with a minimum expenditure of power.



Photos by Andrew Halbran





MODERN VENEERING

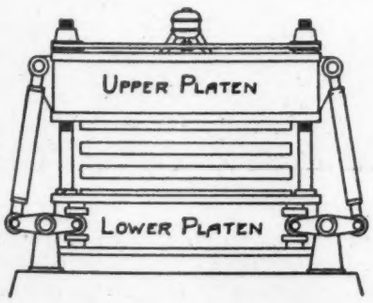
Veneering is usually of 5-ply, meaning that there are five layers. Each assembly consists of a central core of softwood, faced on both sides with two thin layers —one a cross band and the outer one of hardwood. The wood is so placed that the grain is at right angles in succeeding members. At the top left a veneer assembly is shown as it goes into the press where pressure and heat serve to bind the various members into one slab, as illustrated at the top right. A new synthetic glue and an improved press in which the final squeezing action is obtained with compressed air have, together, made it possible to produce the most enduring veneers ever manufactured. The Aeroplat press is seen at the right, with five tiers of plywood being consolidated between the plates. The air pressure is introduced into a rubber diaphragm in the steel box beneath the bottom plate. Six minutes suffice to effect a permanent bond, the heat being introduced as steam through the hose-and-tube assembly at each end of the press. Just above is shown the Ingersoll-Rand high-pressure compressor that supplies air for the press. The pictures were taken in the factory of W. & J. Sloane, one of the nation's leading furniture makers.

As the press was originally designed, a hydraulic ram beneath the bottom platen both closed the press and applied the pressure necessary for the work. The first step towards improving the press was to equip it with an electric motor which closed it by screwing down nuts on strain rods connecting the upper and lower platens. The final squeezing pressure was then exerted through the medium of the hydraulic ram, which action involved only a very short vertical movement.

The next step was to discard the ram altogether and to substitute for it a rubber diaphragm confined in a box the full size of the plates of the press. This virtually constituted a hydraulic platen. When inflated by hydraulic pressure, the diaphragm became, in effect, a ram of the same size as the press platen. This was advantageous in that the pressure was no longer concentrated at one or more points on the underside of the platen where the ram or rams came in contact with it, but, instead, was uniformly distributed throughout the whole area of the platen. Furthermore, it was possible to put the desired pressure on the platen by operating the pumps at only a slightly higher pressure, whereas when rams were used, a pump pressure of from 2,000 to 6,000 pounds was needed to obtain a pressure of 200 to 300 pounds in the press. This was because the rams worked on the differential principle.

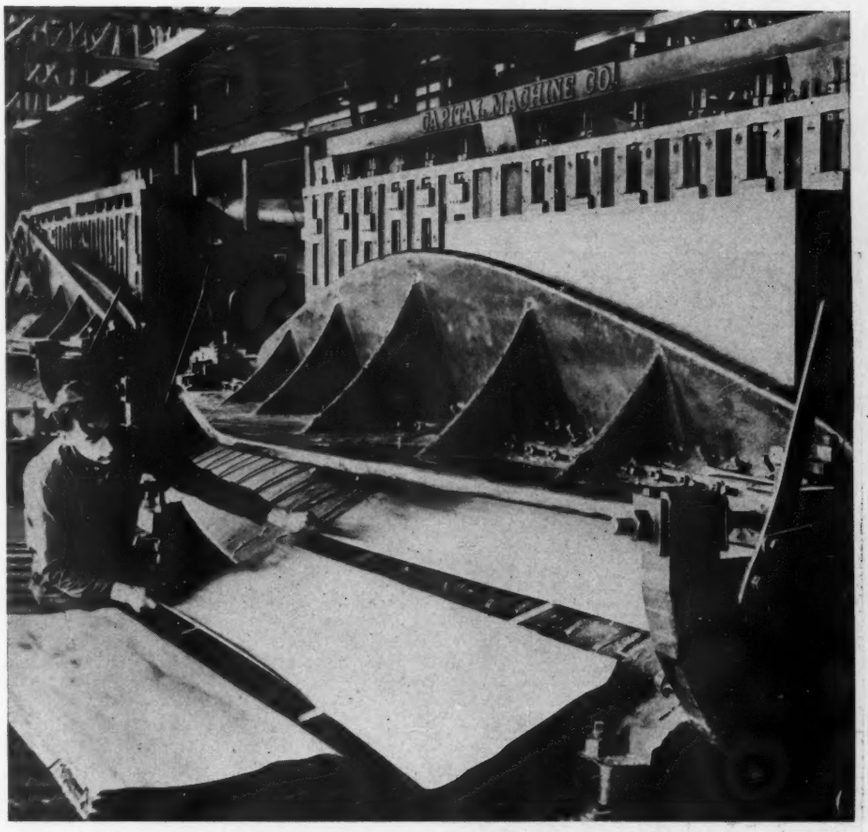
With this achieved, a means was sought to eliminate the necessity of handling heavy weights in closing the press, and thereby to reduce the power requirement. This was done by applying the old idea of the platform scale through the use of rocker shafts and beams, as explained in connection with the accompanying drawing. This change in construction placed the upper and lower platens in balance.

A final mechanical improvement in the operation of the press was effected by providing for differential closing. Previously, the entire closing action was carried out from the bottom upward. As a result, the assembly in the lowermost part of the press was subjected to pressure and heat seconds before the plies at the top received similar treatment. By attaching the vertical rods on which the interply plates are hung to levers supported by the strain rods of the press, the latter could be closed with an accordionlike movement. That is to say, all the openings between the various plates could be closed simultaneously and uniformly.



BALANCED PRESS

The angling rocker arms, one at each side, support the upper platen while their lower ends are attached to the outer extremities of scale beams which rest on concrete. The inner ends of these beams support the lower platen. Thus the two heavy moving elements of the press are brought into balance, and their opening or closing can be accomplished quickly and with a small expenditure of power.



CUTTING MAHOGANY VENEERS

The thin sheets of hard veneer wood are produced either by sawing or by cutting with a huge mechanical knife, as illustrated here. Sawing sometimes leaves marks that have to be removed and also is wasteful of wood, as a section equal to the thickness of the saw blade is reduced to sawdust each time a slab is removed. When the knife-slicing method is used, the log is first placed in boiling water for a number of hours to make the wood leathery and thus to prevent the thin sheets from breaking.

These various changes in the press made it possible to take advantage of the new quick-setting adhesives that had in the meanwhile been placed on the market, with the consequent greater production of plywood at lower cost. The last step was the substitution of compressed air for hydraulic equipment as a means of providing the final pressure. This entailed no modification of the press, as the diaphragm that had been designed for the use of water was suitable for pneumatic operation. Air is an economical medium because the ultimate squeezing action involves a movement of only a fraction of an inch, and the air requirement is very small. An Ingersoll-Rand 15-hp., 2-stage compressor with a maximum discharge pressure of 500 pounds per square inch is ordinarily furnished with each press. Panels can be put under pressure in an air press in seventeen seconds, as compared with 48 to 70 seconds in a hydraulic press.

The photographs that are reproduced with this article were taken in the Master Craftsmen furniture factory in Flushing, Long Island, N. Y., which is operated by W. & J. Sloane. Its products are sold in four Sloane stores and by many dealers. Veneer panels for the better class of furniture are now being manufactured there with the aid of the Aeroplat press, and have been extensively advertised by the store. Sloane's calls the process the Permo-Weld, and states in its advertising that the new technique produces veneered panels that are "practically faultless."

Prior to introducing the furniture, the store made exhaustive tests of the veneered panels, exposing them to sun, rain, and snow on the roof of its factory and shipping pieces to various parts of the world to ascertain how they would withstand the vicissitudes of climates that have always been considered particularly destructive to veneered furniture. The results of these tests were so satisfactory that Sloane's now characterizes furniture incorporating veneers made by the new process as weatherproof, steamproof, waterproof, moldproof, and ageproof.

Magic Doors

Allan S. Park

WHEN a large part of America consisted of frontiers, the doors of many dwellings were equipped with a leather thong attached to a latch on the inside. By passing the thong through a hole in the door it was possible to raise the latch from the outside. A latchstring hanging outside was a symbol of hospitality, signifying that the occupants of the house were "at home" to whoever might call. From this custom, the saying "The latchstring is always out" came to mean, in effect, "You are always welcome."

The modern counterpart of the latchstring is the Magic Door, a mechanical marvel that extends an indubitable welcome to everyone by automatically opening for all who approach within a certain range of it. Although not exactly new, having been introduced in 1930, this type of portal is still a novelty to millions of persons; and even in the larger centers of population, the uncanniness of its never-failing operation continues to intrigue the imagination and to excite curiosity. Probably few people know that compressed air is the invisible hand that opens the door, although in most installations there is a tell-tale "whish" that reveals the character of the motive force.

The Magic Door is a product of the Stanley Works of New Britain, Conn. As is shown in the accompanying sketch, its functioning depends upon a beam of light which is projected across the path between a pair of posts set up a few feet in front of the door. One post contains the light source and the other one a photo-electric cell or "electric eye" upon which the beam is directed. When a person or object passes between the posts and intersects the beam, there is actuated a photo-electric relay which, in turn, causes compressed air to be released through a valve that is controlled by a solenoid in the pneumatic operator normally placed across the top of a door or a pair of doors. The air enters a cylinder and moves a piston to which is attached a metallic arm that opens the door. At the limit of the operating stroke, a cam closes the air valve, and the door is then pulled shut by springs that are housed in the operator.

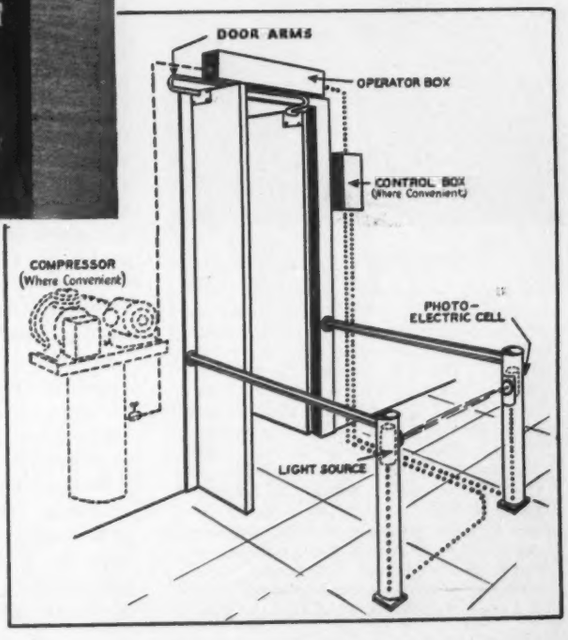
The compressor, which is hidden from view, is a small, self-contained, electric-driven unit mounted on a receiver of several cubic feet capacity. The company standardizes on Ingersoll-Rand air-cooled machines, the size used depending upon the number of doors to be opened. For an average 2-door installation a ¾-hp. compressor suffices. Air at a constant pressure of approximately 50 pounds per square

inch is required to operate a door of ordinary weight. At a busy entrance, the air consumption is about one cubic foot a minute for each door.

The Magic Door was developed in 1930 by an engineer of the Stanley Works, and even though it was tested to the point where its reliability of operation was unquestionable, difficulty was experienced in finding customers for it. Most of those that were approached were interested only in the purely spectacular features of the innovation: they were skeptical regarding its practical benefits. After several months of ineffectual efforts with various prospects, the Frank Wilcox Company was induced to place four of the doors between the dining room and kitchen of its Pier Restaurant at West Haven, Conn. The Stanley Works believed that the doors, because of their novelty, would attract so much attention that they would receive free and widespread advertising which would quickly lead to additional sales. This proved to be a correct surmise. The first installation was seen and commented upon by thousands of persons, and it was not long before inquiries began to come in. Up to the present time, more than 300 installations have been made, and these are to be found in virtually all parts of the country and even beyond its borders.

In some cases, the chief value of the doors to a concern is in the nature of advertising, particularly when they are the first of their kind in a city. Throngs are attracted to view and to marvel over the robot operator, with resultant benefits in sales through the free publicity that is thus obtained. This has proved true in the cases of such establishments as retail stores and theaters. A Boston cafeteria that normally served 3,000 persons daily, discovered that its patronage had jumped to between 6,000 and 7,000 a day shortly after a set of these doors had been installed at its entrance. The increased profits paid for the equipment in six weeks. A Dallas, Tex., department store placed one of the doors at the entrance to its Men's Shop in 1932 and figured that it paid for itself in one month.

In other kinds of establishments, the doors, in addition to their advertising potentialities, render direct service of a utilitarian character. A leading example of an installation of this sort is that between restaurant or hotel dining rooms and kitchens. With both hands free to transport food and dishes to and from the kitchen, waiters or waitresses can move faster and carry heavier loads, thereby speeding up service. There is also a direct monetary saving in decreased breakage of dishes, between 50 and 75 per cent of which is normally attributable to accidents at doors. This breakage is so great that it represents one of the important items of operating expense in the case of national chains of restaurants. It has likewise been found that personal injuries to employees are materially lessened. Ordinary doors are pushed open with the hands or feet, and must be regularly repaired and periodically



TYPES OF INSTALLATIONS

Probably the most used Magic Doors are the eight in the Pennsylvania Station, New York City, four of which are shown just above. They are a real boon to the luggage-laden traveler, and have speeded up traffic materially. A de luxe installation is the one at 40 Wall Street, New York City (top left), in which the doors when closed make up a solid wall of glass. At the lower left is a factory installation that illustrates how the robot doors facilitate the trucking of heavy loads. In the circle are shown attractive models passing through the Magic Doors at the entrance to a Boston furrier shop.

HOW IT WORKS

At the right is a phantom sketch showing the interrelation of the various elements that operate the Magic Door. The compressor is always hidden from view, in fact it may be located a considerable distance away or on another level. It is also possible to place the operator and control box beneath the floor and out of sight.

replaced. As the automatic doors are never touched, they last indefinitely. Furthermore, they are kept free of grease that is generally transferred from hands that have handled food. This, together with the decrease in accidents, makes for improved sanitary conditions.

Another type of installation that gives practical results is that in railroad stations. Passengers and porters do not have to put down luggage in order to open doors, and the flow of traffic is perceptibly increased. Eight such doors are between the main waiting room and the train shed of the Pennsylvania Station in New York City for service during the cold-weather months. They undoubtedly hold the record for the number of persons that use them each day, as they are in one of the world's busiest terminals and are at work day and night.

Still another strictly practical application of the doors and one that promises to become increasingly popular is to be found in manufacturing plants. Interbuilding haulage of raw materials, or of products in the making, is generally handled by storage-battery trucks. In some instances, rolling or sliding doors are provided with operating mechanisms controlled by push buttons placed several feet away from them. More often, however, swinging doors are installed and are opened by the simple expedient of running a truck against them. In either case, a good deal of time is lost in transporting loads; and in the latter case the replacing and repairing of doors represents a considerable expense item. Lighter and less costly doors can be used in connection with the electric-eye control, and traffic is materially speeded up.

SOURCE OF AIR

A small, air-cooled compressor, belt driven from an electric motor and assembled complete on top of its storage receiver, supplies operating air for the doors. The unit pictured is the size usually furnished with a 2-door installation. It is of ¾ hp. and has a piston displacement of a little more than 4 cfm. The compressor discharges at 150 pounds per square inch, and is arranged to start automatically when the receiver pressure drops to a predetermined point and to stop when the receiver pressure reaches 150 pounds. Air from the receiver passes through a reducing valve and reaches the operating mechanism at a constant pressure of about 50 pounds.

Somewhat akin to the service just described is that in hospitals, where the handling of wheel chairs and wagons containing laundry, trays of food, etc., becomes very awkward with ordinary doors. The first installation of Magic Doors in an establishment of this sort is that at the infantile-paralysis hospital at Warm Springs, Ga., which has attained nationwide publicity through its association with President Roosevelt. The railroad hospital in Mexico City also has been provided with four such doors.

There is a growing demand for doors of this description in buildings that are air conditioned. It is essential under those circumstances that doors be closed as quickly as possible—something that is accomplished by the new system—so as to minimize the escape of cool air in summer and warm air in winter. Merchants, traditionally, like to have the front entrances of their stores open in seasonal weather as an invitation to trade; and the necessity of keeping them closed has been their only objection to air conditioning. Magic Doors offset this disadvantage to a large extent, because customers can enter and leave with no exertion on their part.

A recent installation that attracted even more than the usual amount of attention when it first went into service is the one at the Bank of Manhattan Building, 40 Wall Street, New York City. This is the tallest structure in downtown New York; and until the new doors were in place the entrance was subject to considerable congestion. On a normal day, 40,000 persons enter and leave the structure, and despite the fact that there were five doors at the street entrance and six leading to the inner vestibule, traffic was slowed down virtually to a standstill during rush periods. Very large revolving doors near the street line are now used during cold weather. Four of the inner doors are of the robot type, and two are manually operated. This arrangement effectually handles the traffic without the congestion that was formerly experienced.

These Magic Doors are unique in construction. Save for narrow bronze strips at the top and bottom, they are composed entirely of ¾-inch-thick, super-strength "Herculite" glass, which is manufactured by the Pittsburgh Plate Glass Company. As door stiles are eliminated, both inside and out, a solid wall of glass extends clear across the lobby when the doors are closed. The mechanism that controls the operation of the doors is concealed beneath the floor, even the brackets and connecting arms being hidden. All sounds made by the air valves and by the air, itself, have been muffled; and as the beams that play upon the photo-electric cells consist of invisible infra-red light, there is little outward indication as to how the doors function. The day the doors were placed in service, their resistance to shock was demonstrated when "Hank" Greenberg, Major League baseball player, batted balls against them and J. B. Weber, a professional golfer, drove golf balls against them. The crowd that assembled on the first day was so great as to receive editorial mention in several of the New York newspapers.

Although complex and delicate in detail, the Magic Door mechanism is so well designed and constructed as to be highly reliable. Automatic counters with which such doors are equipped show that many of them operate several hundred thousand times without giving trouble. They are also well-nigh foolproof, although two practical jokers in New York City one day hit upon an ingenious way to tamper with them and thus to cause consternation for a time.

The pair of wags chose one of the elevators in the RKO Building at Rockefeller Center as the scene of their first prank. All the elevator doors there are equipped with electric-eye controls to prevent them from being accidentally closed while a passenger is entering. On the morning in question, hundreds of people were attempting to get to their offices on time, and the cars were crowded. One door failed to close properly, however, when the operator pushed the lever. It went partway shut, then suddenly retracted. This was repeated again and again, whereupon the passengers were shunted into another car. There the same thing transpired. Finally, after several different elevators had been tried, and much confusion had been created, one was found that functioned normally.

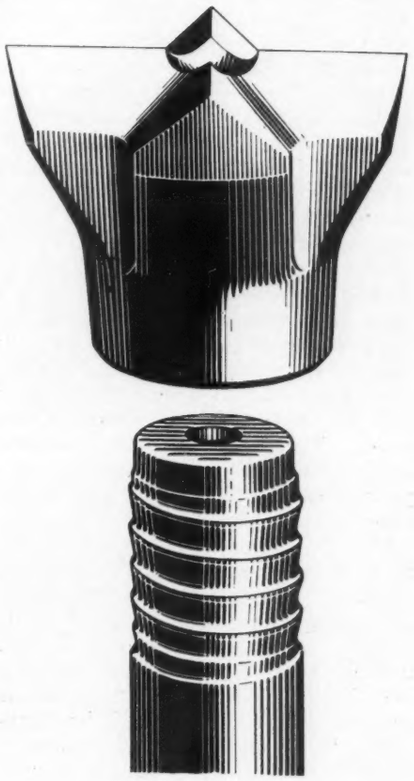
By that time the two men who were responsible for the interruption in service had left. Entering a nearby restaurant they took seats at a table close to the Magic Doors leading to the kitchen. After a few minutes those doors, too, began to act strangely. With no waiter approaching them they would suddenly open. Service was demoralized and the manager was summoned. He could not solve the mystery: but at last the two strangers confessed that they were the cause of it all. They demonstrated how they did it—by blowing smoke from their cigars so that it intercepted the light beam of the electric eye. A newspaper columnist heard the story and published it. Someone connected with Rockefeller Center read it, and now there is a rule against smoking in the elevators in the RKO Building.

Jackbits Used "Down Under"

IN VIEW of the fact that detachable drill bits were developed in the United States, it is only natural that they should be best known there; but it is interesting to note that their inherent advantages are causing them to be gradually adopted in various other parts of the world. Being highly practical individuals, mining men do not take to any new idea without having tested it, and, consequently, wherever detachable bits are appearing they are undoubtedly being used in preference to conventional drill steel because they have clearly demonstrated that they can effect greater economies. A case in point is the experience of the Mount Lyell Mining & Railway Company, Ltd., of Queenstown, Tasmania, where Ingersoll-Rand Jackbits have reduced over-all drilling costs 13 per cent in open-cut operations and 10 per cent in underground operations. The expectations are that these savings will be increased as the miners become more familiar with the bits and their handling. A detailed account of the company's experience with Jackbits, written by G. F. Hudspeth, B.C.E., assistant mining engineer, was published in the *Chemical Engineering and Mining Review* for January, 1938. The article is being digested here with the permission of the publishers, the Tait Publishing Company, of Melbourne and Sydney, Australia.

Early in 1936, following a change in mining policy, production of ore at the Crown Lyell and Royal Tharsis underground mines was discontinued and open-cut operations were begun on a large scale at the West Lyell. The latter property had previously been worked as a subsidiary of the Royal Tharsis, and all supplies had been delivered to it from Queenstown via the North Lyell Tunnel and the Tharsis Shaft. With the closing of the underground mines, maintenance of this transport became uneconomical, and haulage by truck over 4 miles of mountain roads was substituted. With the growth of the open-cut operations, the carriage to and from the existing sharpener shop at the North Lyell Tunnel portal of some 400 to 500 drill steels a day became inconvenient and costly. It was recognized that detachable bits would solve the problem, provided they compared well with conventional steels in performance. As a preliminary test, twelve dozen Jackbits were obtained and used for drilling in typical ground until they were blunt. According to the records, they penetrated slightly faster than standard bits forged on steels and indicated that an even greater footage per sharp bit could be expected.

It was therefore decided to make a more thorough test, but to do so without purchasing a bit-grinding machine. This was effected by making in the company's own machine shops a number of bits similar to Jackbits and sharpening them by hot-



milling. Five Jackhamers, working under close supervision at the same locations, first used these bits for one month and then conventional steels, also for a month. All drilling particulars were carefully recorded and comparative costs calculated. These showed a direct monetary saving of 20 per cent in favor of detachable bits, as well as a greater footage drilled per man-shift and per sharp bit.

Having concluded, on the basis of these tests, to adopt detachable bits for the open-cut work, the company thoroughly investigated the possibility of making its own bits, but found that it would cost less to purchase them. Accordingly, it was decided to use Ingersoll-Rand Jackbits and, because the hot-milling of the locally made bits had not been satisfactory, to install the Jackbit grinding machine made by the same manufacturer. The change from conventional steels to detachable bits was effected in August, 1936.

There are 30 Jackhamers of 2⅝-inch bore in service. These are operated with air at 85 pounds pressure, and each is handled by one man. All Jackrods are of ⅞-inch hexagon steel and come in lengths of from 2½ to 22½ feet. Type I Jackbits are used and are bought in only the largest size, 2¼-inch gauge, from which the smaller sizes are obtained by regrinding. The rock drilled is classified under four heads: 1—hard, abrasive quartzitic schist; 2—very hard chloritic schist; 3—tough sericitic schist; 4—soft decomposed schist. Only the last of these is easy to penetrate: three-fourths of the drilling is done in the more resistant formations.

When the miners go on shift, each is provided with a metal carrier containing twelve sharp Jackbits consisting of three runs of four bits each. He is responsible for these, and must return them at the end of the shift regardless of how many have been dulled. A duplicate carrier is held in readiness in the shop for each man, and this is issued to him the following day, or even the same day should he require more bits. Drillers engaged in pop-holing large bowlders are allotted reforged bits of small sizes, but otherwise the procedure is the same in their case. Similarly, there is assigned to each driller a set of Jackrods, and he must turn in the broken ones to receive replacements. This control system has cut down the loss of bits to a minimum and eliminated the need of carrying unduly large stocks of bits and rods.

Under actual working conditions in the open-cut operations, the substitution of Jackbits for standard forged steels has resulted in a reduction in drilling costs of 13 per cent. The comparative performances and costs are shown in the following table:

Item	Standard Forged Steel	Jackbits
Feet drilled	96,344	197,765
Drilling rate, feet per hour	5.14	5.63
Feet drilled per bit	3.67	3.00
Cost In Cents Per Foot Drilled		
Drilling labor	7.442	6.794
Sharpening	1.454	1.290
New bits	.....	1.504
Reforging bits	.....	0.060
Repairing rods, steel	0.020	0.120
Distribution	0.920	0.082
Transport	1.014	0.100
Steel loss	0.606	0.050
Steel discarded	0.040	.....
Drill lubricant	0.176	0.160
Totals	11.672	10.160

The item of steel loss covers metal that disappears between successive sharpenings. For standard, forged hexagon steel this averages 0.20 pound: for Jackbits it represents the actual loss in length of rod through breakage. In connection with the item of discarded steel, it should be explained that the average bar cut was 15 feet long and that it could no longer be used when worn down to 15 inches. Thus, 8½ per cent of all steel was wasted.

Although, as will be noted, only 3 feet is drilled with each Jackbit, as compared with 3.67 feet by conventional steel bits, this does not indicate that the Jackbit is inferior in this respect. With a plentiful supply of easily handled sharp bits available, the tendency among drillers is to use more of them. This tendency is encouraged by the management from an economic standpoint, for if bits are dulled only moderately, and if each can be used oftener, grinding costs are reduced proportionately. On an

average, each 2¼-inch bit serves 10.3 times, as follows:

	Times Used
Original bit, 2¼-inch gauge.....	1.0
Regrinds down to 1 9/16 inches....	6.3
Reforged bit, 1¾-inch gauge.....	1.0
Regrinds down to 1½ inches.....	2.0

After an average of 7.3 uses, the then 1 9/16-inch bit still retains approximately ⅛ inch of its originally hardened cutting edges. This clearly indicates that gauging and not direct blunting is the principal cause of wear.

It will be observed that the saving of 13 per cent in drilling cost now being realized is 7 per cent less than that indicated when the preliminary tests were made. This is attributable to the facts that grinding costs are higher than at first estimated and that the drillers are not under the same close supervision that they were during the tests.

The sharpening shop is located in the open cut and is equipped with two J2 Jackbit grinders, a portable 12-compartment bin for bits, a rack for Jackrods, and a bench for sorting. It has ample wall space for hanging up the bit carriers. These are grouped in pairs each bearing the same number, which is also painted above their respective positions. An air jet just inside the door serves for blowing out blocked Jackrods.

There are two grinder operators on each shift to receive, sort, sharpen, oil, and issue all bits used. Each one sharpens about 115 bits in eight hours. Experience having proved that sharp cutting edges and corners on wings are destroyed during the first few seconds of drilling, they are left slightly rounded. Bits are not ground at random to any specific gauge at the time they are sharpened. Instead, after being squared up and assorted, each is ground to the next following gauge. This practice decreases the loss of metal with each sharpening, cuts down the grinding time, saves grinding wheels, and eliminates measuring during grinding.

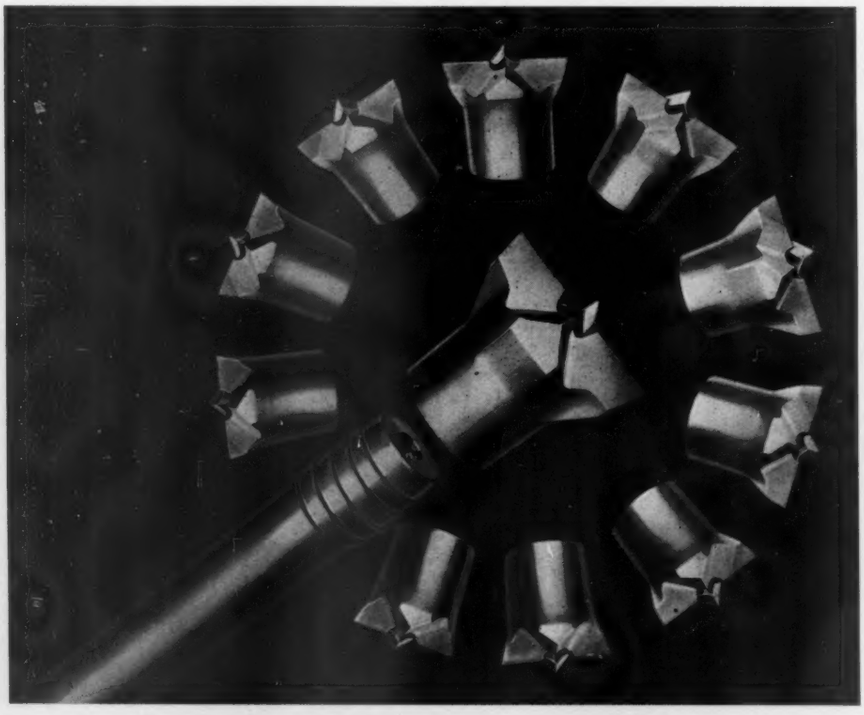
The service life of grinding wheels, which is an important factor in controlling costs, depends largely on the skill of the operators. If properly used, gauging wheels require no dressing and grind, on an average, 1,217 bits. Forming wheels are lightly dressed once each shift and average 3,503 bits each. The head sharpener keeps an accurate record, and this is compiled in a weekly report showing the number of bits sharpened, issued, and discarded each day; the number of new and reforged bits issued; the number of spare Jackrods used; and the number of bits ground by each wheel. The over-all cost of sharpening bits averages 4.430 cents each, as compared with 5.34 cents for forged bits on conventional steels.

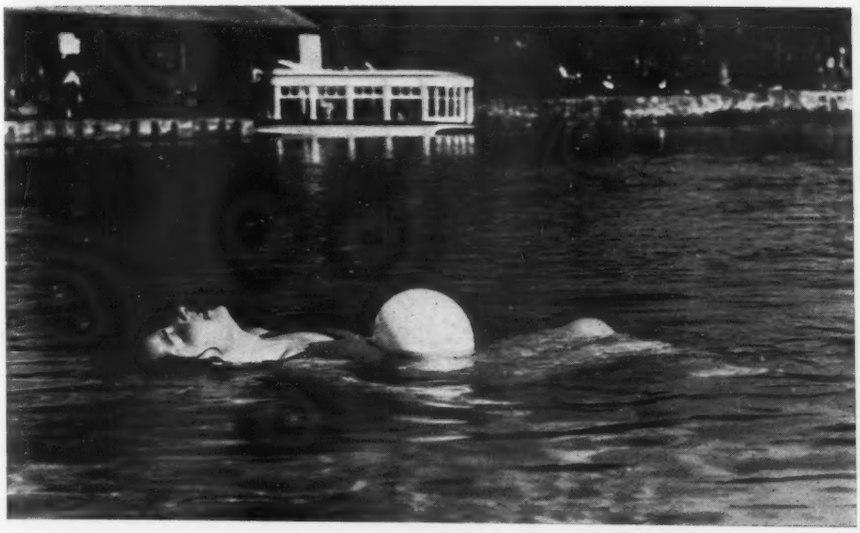
For reforging, bits are heated in an oil-fired furnace on one side of which are nine 1⅝-inch holes cut through the 3-inch brick lining. The flame is so controlled that it has a slight tendency to blow out through these holes and to play on the heads of the bits placed within them. By moving the bits inward by stages, heating is done gradually. At a temperature of approximately 1,600°F., the bits are removed with tongs and clamped lightly in the jaws of a forging machine while a mandrel is inserted in the center hole and screwed in place. They are then reforged to 1¾-inch gauge, a special dolly being used to spread the wings quickly before the metal has a chance to cool. The forged bits are hot-milled and allowed to cool in the air. For hardening, bits are heated to about 1,400° and quenched in ¼-inch of running water. The cost of reforging a bit is 3.5 cents.

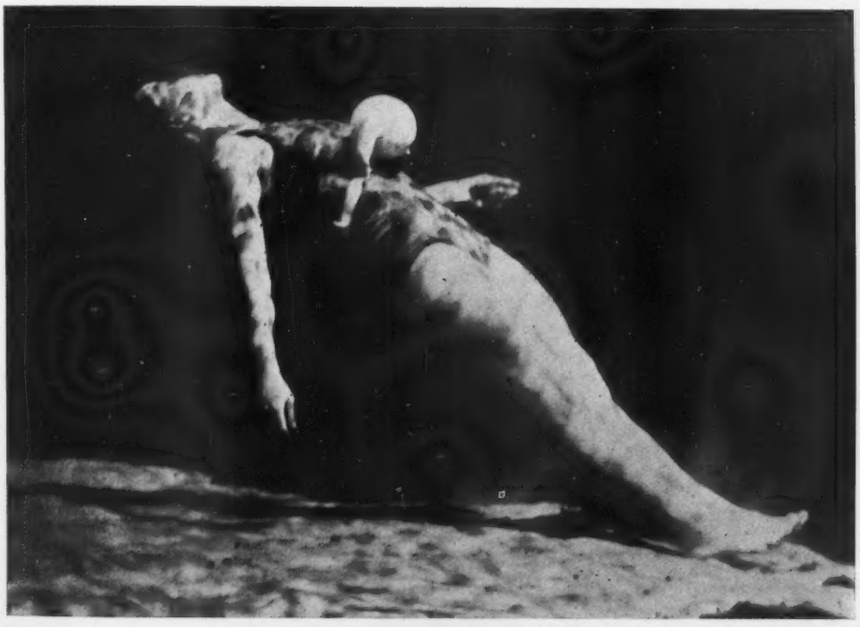
Rod breakage is low—the number of broken pieces during the first 200,000 feet drilled averaging only 4.65 per 1,000 feet. Forty per cent of this breakage represented shank collars, the remaining 60 per cent threads. This is considered a very reasonable figure, particularly in view of the fact that no special steel is used and no special treatment is applied. Shanks are forged in the usual way, two heats being used in the course of the process. They are reheated for hardening and are quenched for a length of 6 inches in Velocite oil. Both lathe-cutting and forging of the threads were tried, the latter method being adopted because of the greater speed with which it can be done. One man forges twelve threads in an hour, as compared with two cut on a lathe. While it lacks something in neatness, the forged thread stands up as well as the machined one in service. Threads are hardened by heating them for a length of 2½ inches to 1,400°F. and quenching them in oil to a depth of ½ inch.

Jackbits having proved themselves so superior for open-cut work, tests were next made with Type 2 bits in the underground workings of the Mount Lyell Comstock Mine. Drifter drills of 3½- and 4-inch bore are in use there; and the ground varies from schist to hard quartzite and dense porphyry. These tests showed a saving of 10 per cent in favor of Jackbits, and, in consequence, they have been adopted for all drilling operations in the property mentioned. The principal saving is in transport and handling, as working places in the Comstock Mine are scattered and the sharpener shop for conventional steels was located 5 miles away at Queenstown. With the changeover to Jackbits, a sharpener shop has been set up at the mine and equipped with a J2 grinder. Results obtained thus far under actual service conditions indicate a slight increase in saving over the 10 per cent shown by the tests.

The 13 per cent saving in drilling cost effected by means of Jackbits in the open-cut workings has, during their first year of service, amounted to more than $5,500. In addition to their apparent advantages, it has been noted that drills are in operation a greater percentage of the time owing to the elimination of delays incidental to insufficient supplies of steel. Although there are no figures available to substantiate this, it is certain that maintenance costs of drilling machines have dropped. This is particularly true of the Jackhamers in the open-cut work. The reason for this is that drillers, through lack of choice, formerly used some drill steels with defective shanks. Now, however, each man has but one set of Jackrods, and he is reasonably careful to have defective ones replaced immediately. Accordingly, the drill pistons are safeguarded against the damage that inevitably results when bad shanks are struck.







Courtesy, Collord, Inc.

HOW LYF-BOY FUNCTIONS

The new life preserver is worn not higher than the chest and not lower than the waist line and with the rubber unit in front. In this position (bottom), it will, as soon as it is inflated (center), bring a drowning person to the surface in a few seconds, face uppermost and with the mouth and nose well clear of the water, as shown at the top.

Safety Afloat

WITH the bathing and boating season in full swing, we are reminded not only of the bright side of the picture but also of the darker one—the many accidental deaths by drowning that mar especially the summer months. Figures given out in the course of a "Learn to Swim" campaign, that was conducted from June 11 to 24 in New York City by the Department of Parks, the Board of Education, and various recreational centers in an attempt to reduce the loss of life by drowning, reveal that deaths from this cause in the Metropolitan area alone total approximately 400 annually.

Unhappily, however, knowing how to swim is not always a safeguard: when the unexpected happens even those that are thoroughly at home in the water may drown. Something more is therefore required to cut down the casualty list, something that will enable those endangered to effect their own rescue. In short, a life preserver suitable for anyone, young or old, and in a form so light and compact that it will not hamper movements whether swimming, boating, canoeing, or yachting, or engaged in any of the numerous maritime pursuits.

Now comes the good news that such a device is available. It is the invention of Clarence V. McGuire who, last summer, had a close escape from drowning in Lake Huron. That harrowing experience prompted him to concentrate his energies on ways and means to avert such disasters. The result of his efforts is Lyf-Boy, a narrow, sturdy web belt that looks not unlike those worn by many swimmers just for the sake of appearance. It is held in place by a quick-fastening buckle. Firmly attached to the front of it is the life-saving feature—a rubber unit 10 inches long and weighing 6 ounces. This lies flat under normal conditions; but in case of danger it can be instantaneously inflated by lightly but positively squeezing one end of it, something that a child can be taught to do. What happens? A combination of harmless chemicals inside the rubber member generates a gas that distends it and keeps it distended, holding a person afloat, face up and out of the water, for at least sixteen hours.

On the Pacific Coast, where the new life preserver was first demonstrated, such organizations as the Red Cross and the Boy Scouts of America have officially adopted Lyf-Boy, so it is reported. If it does all that is claimed for it, and the many practical tests it has undergone would seem to indicate that it does, it will, indeed, be a boon. Timid souls will be able to enjoy water sports, the work of lifeguards at recreational centers, bathing beaches, etc., will be easier; resort and camp life will be safer; and parents, especially, will have one less cause to worry about.

ULTRA-VIOLET MAGIC

WE USUALLY think of the ultra-violet lamp as a means of obtaining a Florida complexion in the winter time without leaving our northern abodes. We are not all aware, however, that it is fast becoming an important factor in safeguarding our health in countless ways. Five years ago Doctors Rentschler and James of the Westinghouse Lamp Research Laboratories demonstrated that ultra-violet rays could be used to advantage with refrigeration and air conditioning, and from that beginning their field of usefulness has vastly broadened. The lamp that is ordinarily utilized has been aptly named the Sterilamp. Essentially, all that is necessary to effect sterilization with it is to place it in the immediate vicinity of the substance or product to be treated. Already it is being extensively employed in various kinds of establishments, and it is very likely that it may ultimately be put to service in homes.

Tests have shown that an exposure of 1.2 seconds to the rays suffices to kill 90 per cent of the bacteria in the air passing through a supply duct of an air-conditioning plant. As a result, the lamps are being used by the manufacturers of several products. Among these is a leading maker of toothpaste and cosmetics. Experiments with animals have revealed that wounds are kept sterile by exposure to the rays, and, in consequence, several hospitals have installed Sterilamps in their operating rooms.

Thus far, the greatest application of the lamp has been in the food industry. Retail meat dealers have found the rays effective and economical. Meat-storage refrigerators have always been maintained at temperatures of from 32° to 50°F., depending upon whether mechanical equipment or ice was used. The lower range has greater preserving power, but it takes the moisture out of the air in the form of frost and results in dehydration of the meat. In ice-cooled storage boxes the humidity is high but the temperature is such as to permit the development of mold and slime. Flooding the room with ultra-violet rays kills the bacteria that cause these conditions, and it is necessary only to keep the meat sufficiently cold to prevent flabbiness and to render it firm enough to cut well.

Bakeries and dairies are beginning to use the Sterilamp with beneficial results; and a number of farmers employ it to keep chicken houses and pig pens free from contaminating bacteria. Soda fountains and restaurants can effect complete sterilization of glassware and dishes by this means, something that otherwise requires the use of live steam. One of the more unusual applications is in a bank, where a lamp is installed over each teller's window to reduce the hazard of communicating disease-breeding germs.

POWER FROM VICTORIA

THIRTY-TWO years ago, engineers toyed with the idea of utilizing the latent power of Africa's magnificent Victoria Falls for supplying the mines of the Witwatersrand gold fields. A company was formed and permission to use the water was obtained; but that was about as far as the movement went. The chief obstacle was the transmission distance—some 700 miles. High voltage lines are common now, but in 1906 the difficulties attendant upon conducting electricity at the great pressure that was demanded were considered too great to be successfully surmounted.

Accordingly, the falls remained untouched by the hands of man; but now a beginning has been made on the work of harnessing the 343-foot cascade of water. Last March a 1,000-kw. plant was placed in operation, and provisions have been made to quadruple its capacity. It utilizes only a minute fraction of the available power, and the energy it produces will all be consumed locally by hotels, residences, and a few industrial establishments. The station is entirely automatic, and the prospects are that it will have to be visited only once a day under normal circumstances.

Since it was proposed to use the power of the falls for mining, the vast copper deposits of Northern Rhodesia have been opened. They are much closer than the Rand; and with the mines pouring out $50,000,000 worth of copper annually, the time may not be remote when additional and larger generating works will be built.

AN ENGINEER ABROAD

MAJOR Oliver J. Todd, who is credited with knowing more about the economic conditions of China than any other person and who has contributed more to the welfare of her people than any man in history, has recently returned to this country—his work halted by the undeclared war. Major Todd is a civil engineer who has spent nearly twenty years in China building roads, waterworks, irrigation systems, and power plants that have vastly improved the living conditions of untold numbers and actually saved the lives of hundreds of thousands of persons.

A University of Michigan graduate, Major Todd spent nine years in hydraulic engineering in California, then went to France for war service and received a citation from General Pershing. Since 1919 he has been in China, where he has carried out one engineering project after another despite the difficulties presented by floods, famines, and banditry. In 1921 he built 500 miles of roads in 90 days to relieve famine-stricken districts; and he has since directed operations of many kinds in virtually every province of the huge country. During that time he has traveled hundreds of thousands of miles, many of them on foot. Among his major works that await completion is a scheme for developing 50,000 kw. of hydro-electric power from the Yellow River. Along with his planning and directing, he has found time to train hundreds of Chinese engineers who will, in years to come, carry out many of the projects that he was forced to leave undone.

This and That

New Process Outgrowth Of War

There have recently been placed on the market in the United States preserved fruit juices which have been treated by a new process that obviates pasteurizing them or adding preservatives, either of which modifies the fresh-fruit flavor. The new treatment consists of bringing the juice in contact with plates of silver which, without altering the chemical composition of the juice, destroy the bacteria that would ordinarily cause spoilage. Consequently, the juice retains the full flavor of the fresh fruit as long as it is kept in an airtight container. The process is patented, and owes its existence to research that grew out of discoveries made during the treatment of wounded soldiers in German hospitals during the World War. Surgeons noticed that gunshot wounds made by French bullets healed faster and were less susceptible to infection than those caused by German bullets. This led to investigations of the effects of different metals on bacteria of various kinds; and it was from the data thus obtained that French food chemists in 1934 developed the new process of preserving fruit juices.

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Fighting Western Words

The following letter, condensed to save space, appeared in the *Deco Trefoil*, published by the Denver Equipment Company, Denver, Colo. If the man that wrote it ever goes fishing, he ought to produce a yarn worth hearing:

"A short time ago, upon reopening a mine that had been closed for some time, we decided to repair the telephone line extending to it. As the line followed a fine fishing stream, long pieces of wire had been cut out of it to string fish on; you see, it was really a fine fishing stream. The old line was of 8-gauge galvanized iron wire, but as we had a lot of copper wire of the same size, we decided to splice in pieces of it where the 'stringing' had been done. We made a good looking job of it and hooked up the telephone to try it out. It seems that the exchange operator on the other end had a slight impediment in her speech and was touchy about it. When we began talking to her, she claimed that we were imitating her to make fun of her and said she was insulted. We suspected trouble in the line and went over it many times, but with no success. Finally, in desperation, I sent a young correspondence school graduate out to see if he could solve the mystery and, believe it or not, he did. It was this way: the old wire being iron and the pieces we put in being copper, they did not have the same conductivity. Consequently, when a word hit a piece of copper wire, it jumped ahead too fast and caught up with the word ahead of it. This, of course, made the first word sore and it kicked the second word in the face, etc., etc. We haven't got the trouble fixed yet, but I'm leaving it to you to tell the world that truth is still stranger than fiction."

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California Surveys Snowfields

It seems strange to consider snow as a crop, yet it is thus spoken of in California, where it is vital to the well-being of the state. Each spring since 1929 a survey of the winter's accumulation of snow in the mountainous regions has been made by the California Coöperative Snow Surveys, an organization supported by municipalities, public utilities, irrigation districts, and other public and private groups that use water. The investigations are conducted under the leadership of the Division of Water Resources of the state government. The area, depth, and density of the snowpack are gauged in numerous places, and from these data is calculated the amount of water that will flow down the streams to serve farmers, placer miners, power houses, manufacturing plants, municipalities, and other consumers. On April 1 of this year it was estimated that the snowfields of the Sierras, aggregating 17,000 square miles, held in storage 33,000,000 acre-feet of water, as compared with 4,000,000 acre-feet then in the man-made reservoirs of the same region. The snow gaugers travel from 12 to 30 miles a day. They sleep in cabins that are spaced about 12 miles apart and supplied in advance with food and bedding.

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Toll Roads Shunned

Toll bridges, which were once the rule in America, are becoming rather numerous again, and there is a noticeable agitation for toll roads. Highway authorities decry this movement, and predict that it will have an unsatisfactory ending. They believe that the general public's antipathy to tolls—which went so far in the early days that the farmers built "shunpikes" around the toll-collection houses—still exists, and that toll roads in this country will prove as unpopular as recent events have shown them to be in Europe. A few years ago, Italy built 300 miles of toll roads to scenic lake regions in the northern part of the country. The government, the localities concerned, and private companies which were to operate them each paid one-third of the cost. Despite their relatively small investments, the companies have barely taken in enough money to maintain the highways and, excepting from one road, there have been no profits. Germany had intended to charge for the use of its new system of high-speed automobile roads; but, after serious study, reconsidered the matter and made them free.

Franklin On Air Conditioning

Although best known as a diplomat and statesman, Benjamin Franklin was a scientist at heart and always hoped that he might some day retire from public life and devote himself to scientific work. A great believer in fresh air—it is said that he sat unclothed in his bedroom with the windows open for half an hour each morning—he was an authority on ventilation, and, if he were alive today, he would perhaps be a consultant on air conditioning. He wrote a paper on the causes and cures of smoking chimneys that received widespread attention here and abroad. At one time he was asked by the British Government to improve the ventilation in the House of Commons in order to give the members greater comfort. He suggested that "the atmosphere surrounding the members might be carried off by making outlets in the perpendicular parts of the seat, through which the air might be drawn off by ventilators." He also proposed making openings close to the ceiling and connecting them with a flue ascending the wall near the chimney so that the heat might induce a vigorous upward draft. It is not recorded whether his scheme was followed in the case of the parliamentary chamber; but it was put into effect in a large room used as a meeting place by the Society for the Encouragement of Art.

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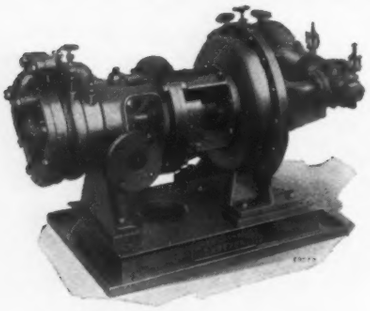
Blue Repels Flies

Although scientists say that flies are color blind, a British architect, G. B. J. Athoe, reveals in a letter to the London magazine *Paint Manufacture* that they seemingly dislike blue. During visits to a number of French hospitals and clinics, he observed that most of the walls were of medium blue, and when he inquired the reason therefor he was informed by architects and doctors that the color was adopted to keep flies away. Further investigation disclosed that in various other parts of the world blue is used for the same purpose and with reported effectiveness. A Dutch engineer has informed him that he has painted the exteriors of a number of abattoirs and manufacturing plants in Denmark a bright blue, and that the buildings were remarkably free from flies.

"In my own house," Mr. Athoe wrote, "all kitchen doors and cupboards are painted powder blue, the ceiling very pale blue, and the walls, where not tiled in white, are papered in blue and white. It is quite exceptional to see a fly in this room, although at least one of my neighbors is so pestered with them that he has two fly-papers in use (with good catches) at the present time. Very few flies enter any part of the house, presumably because if their usual means of entry, the kitchen, is made distasteful, they do not come in at all. As I write there is not a fly to be seen in the dining room."

Compactness Stamps New Turbine-Driven Pumps



TWO-STAGE UNIT

This 16-hp. pump is used for boiler-feed service and delivers water at a pressure of approximately 200 pounds.

INGERSOLL-RAND Company has announced a new class of turbine-driven pumps—the TRV, compact units with the turbine and pump mounted on a common shaft. This construction, which eliminates couplings, has made for substantial savings both in weight and size. The single-stage 15-hp. pump, for example, is about 32 inches long and 21 inches wide, as compared with approximately 60x25 inches occupied by an ordinary turbine-driven pump of the same capacity. The reduction in weight and size has other advantages: It cuts down the first cost and also the expense of installation and up-keep. No special foundations are required, and the pumps can be bolted to the floor, wall, or ceiling, or on to a tank, column, or other convenient structure.

TRV pumps are available in single-stage sizes ranging in capacity from 5 to 1,000 gpm. against heads as high as 220 feet, and in 2-stage units capable of handling a maximum of 275 gpm. against heads up to 550 feet. They have many applications, and are especially suitable for use in refineries, chemical plants, mines, and elsewhere where dangerous gases are present, in plants where process steam is required, and for boiler-feed service at pressures around 200 pounds per square inch. They can be used to advantage, within the limits of their capacity, in fields heretofore served by duplex steam pumps. Detailed information about these new pumps is contained in Bulletin 2390, which can be obtained from the company's main office, 11 Broadway, New York City, or from any of its branches.

Air-Operated Spray Gun Applies Hot Paint

HOT spray-painting is a new development in the art made practicable by a gun that has been introduced in England. In the main, the pistol used differs from the cold-spray type in several particulars. It has a double-walled reservoir the inner wall of which is wound with an electrical heating resistance connected to a gasoline-engine-driven dynamo producing 500 kw. at 200 volts. The engine also operates the compressor which supplies the air that feeds the paint to the nozzle. The latter has two caps —the regular paint-spray cap and, outermost, a circumferential burner cap which consumes compressed gas that may be drawn from a flask through a flexible tube. The paint used consists of resin, wax, white zinc and graphite, and comes in the form of cartridges that fit into the reservoir.

In operation, says *The Engineer*, the current is first switched on to liquefy the paint compound. The gas is then turned on, and when the burner is lighted the pistol is ready for service. The flame surrounding the jet of paint prepares the surface of the metal for its application. This is of advantage, especially in the case of metals exposed to moisture, for the heat warms and dries the surface. No primer of lead is required. The Pahl method, as it is called, results in a dense coat not unlike enamel that has strong corrosion-resisting properties.

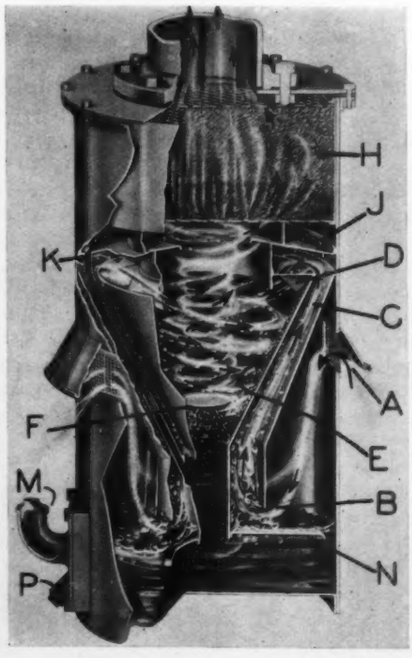
NEAT AND HANDY

For those that have to study maps and complicated plans and layouts, the new Bausch & Lomb magnifier-caliper should prove useful. The calipers are hinged to the frame of the magnifying glass; and when the instrument is folded up it is approximately 2 inches in diameter. It comes in varicolored mountings and in a leather case.

Air Filter for Work in Very Dusty Places

A NEW oil-bath type of air cleaner has been developed by the American Air Filter Company, Inc., for the protection especially of air compressors and of oil and gas engines that are exposed to extremely heavy concentrations of dust. The principle on which it operates is said to be a departure in cleaners of this kind and to give the Cycoil, as it is named, exceptional advantages. Briefly, the effectiveness of the unit is attributed to the fact that it precleans the compressed air—frees it of most of the entrained dust and oil before it reaches the filter cell.

As the accompanying drawing shows, the dust-laden air enters the ports *A*, which are screened and protected against rain. Sweeping downward and across plates *N*, it is intimately mixed with oil at *B* and receives its first cleaning, as the heavier particles of dust are deposited in the oil bath at this point. Next it is carried upward through passages *C*, where it is further cleaned by brushing against the oil-coated walls. Impinging against *D*, the direction of the air-oil mixture is reversed. In its passage downward into the cone-shaped element *E* it is brought in contact with vanes which give it a whirling motion, thus throwing the dust and heavier oil particles against the walls whence they flow by gravity back into the oil reservoir through pipe *K*. Thoroughly precleaned, the air is caused to spiral upward into and through filter cell *H* by means of plate *F*, which also serves to prevent the dust-laden air at the tip of the cone from being swept along into the filter. There the last trace of oil and dust in the air is removed, the dust being held while the oil drains through *J* and *K* into the reservoir for recirculation, the foreign matter settling to the bottom. Any floating dust, lint, etc., is caught beneath plates *N*.



Normally, maintenance involves draining the oil reservoir periodically, removing plate *P* to scrape out the sludge, and refilling with clean oil to the top of filter plug *M*. The filter cell of crimped wire does not require frequent cleaning because of the precleaning of the air. Cycoils are available in sizes capable of handling 250 to 2,000 cubic feet of air per minute.

Industrial Notes

FOR the installation of pipe flanges, couplings, cylinder heads, pump casings, etc., that should be leakproof, Bonney Forge & Tool Works has developed a ratchet wrench that automatically measures the torque of each bolt as it is tightened. The No. 66 Bonney Torque Indicat-

ing Wrench, as it is called, works just like any ratchet wrench; but there the similarity ceases.

As the accompanying illustration shows, it is provided with a scale and indicator which is set by means of a clamping screw at the predetermined torque in foot pounds. With this done, and the ratchet lever moved to the starting point at the extreme left, the tool is ready for use. When the desired torque has been reached, the ratchet lever snaps to the neutral position in the center and locks, at the same time giving a sharp click, an audible signal that the bolt is drawn up as it should be. By simply shifting the ratchet lever back to the starting point, the wrench is ready for the next bolt, and so on, until all are in place and uniformly tight. Only when a change in torque is required is it necessary to reset the indicator.

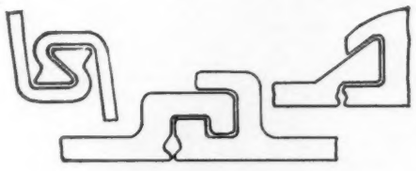
Willson Products, Inc., has issued a new 34-page catalogue describing and illustrating its complete line of industrial safety devices, including more than 50 kinds of goggles for every conceivable purpose, welding hand shields and helmets, dust and air-line respirators, abrasive helmets, etc., etc. The firm was established in 1870, and is said to have been the first to specialize in the manufacture of appliances for the protection of industrial workers. Copies of the catalogue, entitled *Willson Products for Industrial Safety*, may be obtained from the company, 241 Thorn Street, Reading, Pa., upon request.

Metals such as nickel, German silver, brass, copper, iron, and steel can, it is claimed, be given an imitation-gold finish by electroplating with a new material called Gold-glo produced by the Special Chemicals Corporation. It is added to water and permits of color variations, ranging from very pale (almost white) to deep yellow, by changing the voltage of the current. From 4 to 9 volts are needed to do the work. If the plating is done in a steel tank, the tank itself constitutes the anode. For permanence, the finish is protected by a coat of lacquer.

Recognizing the importance of the plastics industry, Germany is establishing a Plastics Institute. The building is now under construction on a site near the Frankfort University at Frankfort-on-the Main. In addition to completely equipped laboratories, it is to house a permanent exhibition of plastic products, materials, and processing machinery that is, according to present plans, to be kept up to date.

After twenty years of research, a Japanese chemist has succeeded in producing an inorganic paint, according to *World Trade Notes on Chemicals and Allied Products*. The new protective coating is lusterless, and is said to dry quickly, to adhere firmly, and to be proof against fire and moisture. Its silicic base makes it especially suitable for finishing brick and concrete structures.

Steel sheet piling that can be solidly and easily packed to make it watertight has been designed and patented abroad. As the cross-sectional drawings show, the channels to receive the packing are accessible so that when any of it becomes jammed on its way down it can be reached by a suitable tool, loosened, and dropped to



the bottom or on top of that already in place. It can also be inserted from the open side of the channel, spread out, and tamped, if necessary. This prevents gaps that are unavoidable with tongue-and-groove piling of the ordinary kind.

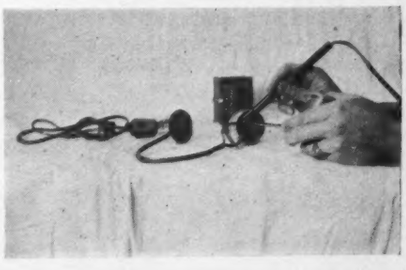
Insects that are so tiny that they can pass through fine wire screening are menaced, as well as their larger fellows for which it serves as a barrier, by a new type of screen that will electrocute them when they alight upon it. The screen, trade named Durobar, is in the form of a panel of horizontal rods held in place by vertical bars, all of copper-bearing steel and mounted on moistureproof insulators. By means of a small transformer, for either 110- or 220-volt alternating current, alternate rods are charged in opposite polarity. The maximum current input is approximately 4 watts, which is harmless to humans but death to flying insects.

Flexrock Company announces an improvement in its roof repairing material known as Rooflex. The material as now made can be used not only on dry but also on wet surfaces, and comes in three forms—one plastic and two liquid—for filling holes and large cracks, for priming and repairing small cracks, and for recoating dried-out surfaces. Rooflex is made of mineral asphalt mixed with castor and chinawood oils and asbestos fibers. The proportion of the latter in the plastic material is 20 per cent and in the liquid—except the primer which contains none—5 per cent. All are applied just as they come, no heating or special preparations are required.

Building construction in Europe is undergoing a change and all because of the uncertainty of existing international relations. In Paris, the Municipal Council recently decreed that all new structures put up for commercial, industrial, or official use shall have roofs of incombustible materials; that the top floor shall be sufficiently strong to stand up under the impact of a 22-pound bomb; that walls which separate buildings shall be provided with fireproof screens; and that the lowermost floor shall be designed to carry the weight of the entire structure in the event of its collapse. In addition, the specifications require bombproof shelters large enough to accommodate 150 persons.

Hydraulic coal-mining is being experimented with in Russia and, judging by reports, has reached a stage that warrants its practical application. The equipment used consists essentially of a hydraulic monitor which delivers a powerful stream of water that serves not only to cut the coal but to remove it from the working face. At the time of the initial tests in a colliery producing coal of average hardness, the monitor operator was able to mine 20 tons in an hour. The water was delivered at a pressure of approximately 220 pounds per square inch, cutting the coal like a knife and washing it into a drain connecting with a sump. From there it was transported to the surface by mechanical means.

For light, delicate work on radios with their maze of wires, for telephones, small motors, instruments, etc., Ideal Commutator Dresser Company has added the Handy to its line of Thermo-Grip solderers. This electric tool is only 6½ inches long and 7/16 inch in diameter, a little thicker than an ordinary lead pencil. It contains two carbons: one fixed and the other movable



against a spring. When both come in contact with metal, an electric circuit is closed, bringing the metal to soldering temperature almost instantly. The heat is confined to a limited area to prevent damaging adjacent parts; and because of the movable carbon it is easy to apply solder to uneven sur-

faces. The No. 1 Handy consumes current only when in use. The complete outfit includes a 6-foot lead and a transformer with a 6-foot cord and plug.

Unibestos is the trade name of a new insulating material for hot-water and steam pipes up to 24 inches in diameter, tanks, etc. It comes in flat, semicircular, tubular, and other sections for easy application.

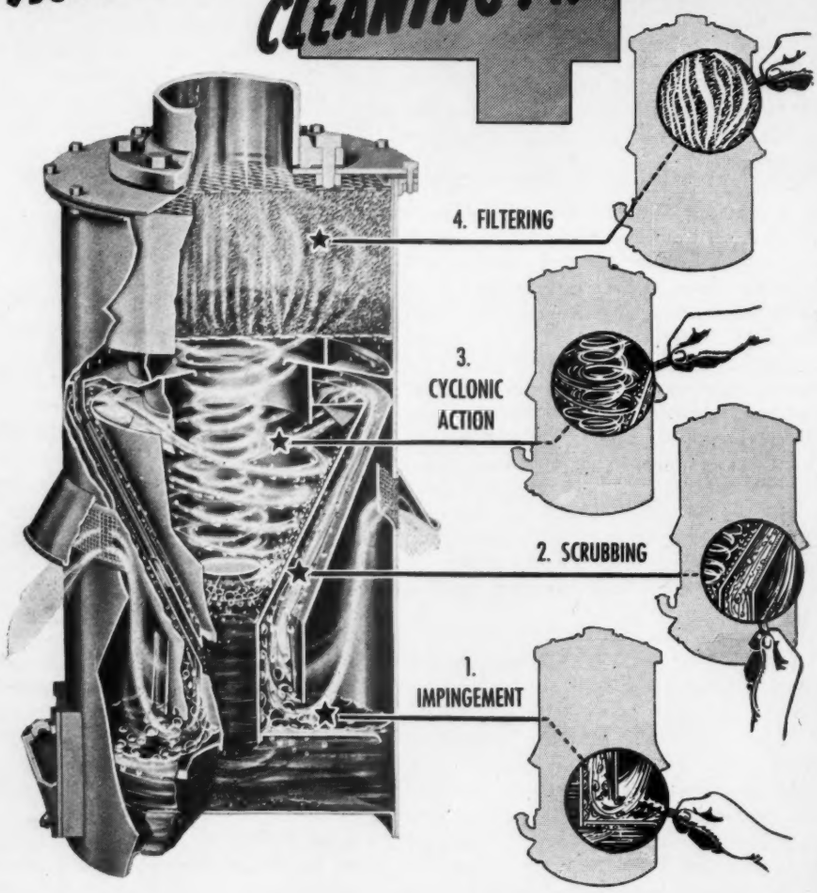
Rope with a wire core has been developed by The B. F. Goodrich Company primarily for the protection of suction and discharge hose handling oil. When wrapped around the hose, the spiral wire holds the rope in place and prevents unbraiding when some of the strands are cut.

Insulating tapes of glass yarn are one of the newest products of the Corning Glass Works. Woven from fibers even finer than human hair, they are as flexible as ordinary textiles but, being made of glass, possess exceptional electrical properties, are highly resistant to heat and chemical action, and are moistureproof. The fabric can be readily impregnated with resins, gums and varnishes. They are intended for the insulation of cables and other electrical conductors and of coils for motor, generators, transformers, etc.

The Garlock Packing Company is offering a new line of leather packing—Garlock Bitan—which is designed for high-pressure service. It is made of carefully selected material tanned and treated by a special process and formula, and is said to combine the best qualities of both Oak and Chrome leather. According to the manufacturer, Garlock Bitan has exceptionally high tensile strength and greater resistance to heat and to acid and alkaline solutions than ordinary leather packing. It comes in all commercial shapes and sizes—molded cups, U or V packing, flange or hat packing, washers, gaskets, and disks.

Ledloy is the name of a new steel alloy that has been put on the market by the Inland Steel Company for the making of such machine parts as gears, pinions, spindles, crankshafts, spark plugs, etc. The physical properties of the steel are not affected by the contained lead, which is said to speed up the rate at which the metal can be machined. According to the manufacturer, Ledloy 1120, for example, can be machined from 30 to 60 per cent faster than SAE 1120. The alloy can be carburized the same as ordinary carbon steel; and heat-treating gives it a case-hardened surface with a tough, ductile core. It is obtainable in hot- and cold-rolled form, being cold-finished by producers of cold-drawn steel such as the Wyckoff Drawn Steel Company which is offering Ledloy cold-rolled bars in all standard analyses and in a wide range of shapes and sizes.

CYCOIL OIL BATH AIR CLEANER HAS FOUR CLEANING PRINCIPLES



POSITIVE protection against oil contamination and wearing of motor parts due to dust and grit is assured when engines are equipped with the new Cycoil Oil Bath Air Cleaner. Not just one or two—but *four* distinct cleaning operations are available in the Cycoil. This guarantees a continued self-cleaning action due to the fact that all large dust particles including lint are removed by a cyclonic action which also provides higher cleaning efficiency.

Write for bulletin No. 130-A for complete information.

AMERICAN AIR FILTER CO., INC.
Incorporated
108 Central Ave., Louisville, Ky.
In Canada: Darling Bros., Ltd., Montreal, P. Q.

AMERICAN *Cycoil* OIL BATH AIR CLEANER